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WIRING FOR CONVENIENCE.

The wiring of most residences has in the past been installed purely with a view to electric lighting. In very many cases the most convenient arrangements for lighting have not been adopted, owing to the increased cost of running conduit and wires to wall switches. As a result it has been necessary to use fixtures which brought the socket within reach of a person of average height, even though they did not leave clearance for a tall person to pass under. The introduction of pendent switches, and of pull-sockets with chains, improved the situation greatly in this respect, but left much to be desired. The experience of groping around in the dark for a chain or a switch is one not foreign to many of us. If the user of the lights gave consideration to these matters before the contracts were let, it is probable that more wall switches and other conveniences would be installed, but too often the contractor is required to submit an estimate too low to admit of anything more than the bare necessities, and the house-owner does not realize the possibilites of the case, but thinks that if the premises are simply "wired," so as to pass inspection, he is getting the full benefit of the advantages of electric current.

When we come to consider the use of electric appliances of other kinds in the household, the facilities are usually wofully inadequate. In the usual residence installation there is no provision whatever for the attachment of heaters, motors, etc. Where there are wall brackets, connection can usually be made to these, sometimes with convenience and sometimes without, although the appliance may often be left permanently connected. Where there are only ceiling electroliers, the connection is usually made with inconvenience, and a lamp must usually be removed first. Where the lights are entirely inclosed by globes, the necessary trouble is a total discouragement to the average person. And where indirect lighting is in use, the connection is usually out of the question!

In a great many houses, and especially in apartment houses, the kitchen, laundry, bath-room, bed-rooms, halls, etc., are each supplied with but a single light, and no extra sockets. How is an electric iron, sewing machine, fan, vibrator or other appliance to be used after dark?

We called attention in these columns in our last issue to the desirability of the central station using its influence to

secure adequate installations in all new buildings, since a lack of facilities greatly discourages the use of current, while the readiness of service is a leading argument in the introduction of current-consuming devices. It will greatly repay any station manager to keep in touch with all building developments in his territory, even to small residences, and when necessary point out the inadequacy of a proposed installation. The contractor has much greater opportunities for suggestions of this kind, and while his interest in proper facilities is not so great as is that of the central station, the size of his contract could often be increased by a clear statement of the future inconveniences resulting from a skimpy installation.

No room should be left with a single outlet, and most rooms require one low down on the wall. The vacuum cleaner invades all parts of the house, and should be everywhere provided for. In the laundry, wall outlets are needed for the iron and the washing machine, and in the kitchen for the general utility motor. In the dining room it should not be necessary to have a cord dangling from the dome or a side bracket, but an outlet on the floor should connect to several receptacles on the table, so that toaster, coffee-percolator, etc., can be operated simultaneously from switches within easy reach.

It has been customary to equip laboratories and other work-rooms with these facilities, but it has not been recognized that they are equally desirable in the residence. But if domestic appliances are to be extensively utilized, it is necessary that their use should be made convenient.

IRON LEADING-IN WIRES FOR INCANDESCENTS.

At the recent British Association meeting at Sheffield, England, Dr. H. J. S. Sand, of Nottingham University, presented a paper describing some researches which may have an important influence on the making of incandescent electric lamps and effect a saving of perhaps some hundreds of thousands of dollars a year to the lamp manufacturers. Dr. Sand's discovery relates to a new method of hermetically sealing wire into glass, and it is suggested that this process may obviate the use of platinum leading-in wires for incandescent lamps. The process is quite simple and the cost should be inconsiderable. Briefly, it consists in fusing a piece of iron wire into the glass, and, while the latter is still hot and plastic, pushing a small hot steel tube surrounding the wire a short distance into the glass, and then welding the tube to the wire. The contraction of the tube makes a perfectly tight seal between its inner surface and the glass on cooling. No practical use of the discovery seems yet to have been made but it is to be expected that experiments on a commercial scale will shortly be announced.

According to the account which has reached us, the experiments were conducted with iron wire. For use in incandescent lamps, copper wire would be preferable to iron, but it cannot be said as yet whether the process is entirely successful when copper wire is used. But even with iron wire the new process probably marks another step in the cheapening of the incandescent lamp. Although the amount of platinum now necessary is very much less than that formerly required, its entire elimination would be a distinct gain. This item may be even more important in the future, for the price of platinum shows a steady tendency to rise.

ECONOMY IN SWITCHBOARD LIGHTING.

In view of the pressure lately being put upon the operating engineer to look at both sides of a cent before spending it, something ought to be done to cut down the cost of switchboard lighting in plants where the old carbon lamp still holds its position at the top of the panels. The efficiency of the smaller sizes of carbon lamps easily runs between 3.5 and 5 watts per candlepower. Few switchboard panels are provided with anything larger than the sixteen-candlepower lamp, and in not a few cases the eight-candlepower size is apparently all that is needed. The substitution of lamps of higher efficiency would be a decided improvement, not only in the quality of the lighting, but in the cost of the service rendered.

The amount of energy required to light a switchboard is, of course, small in most cases, but the improvement costs little or nothing to make, and can be applied gradually as the carbon lamps burn out. The smallest tungsten lamp as yet built for operation on 110-volt service is rated at twenty candlepower. The substitution of this size for sixteen-candlepower carbon lamps would give for the same number of lamps twenty-five per cent more illumination for only about half the expenditure of energy required under the old régime. The efficiency of the tungsten lamp is well maintained at 1.25 watts per candlepower even in the smaller sizes, and the replacement of 110-volt, sixteen-candlepower carbon lamps by twenty-five-watt tungstens would be a great improvement in switchboard lighting provided the installation were made in such a manner that the light is properly screened from direct vision. Otherwise, the increased illumination is certain to make it more difficult to read the instruments. As every decent carbon-incandescent installation on switchboard panels is shaded, there should not be the slightest difficulty in screening the tungsten lamp in this service.

If the use of twenty-candlepower tungsten lamps is regarded unfavorably on account of the amount of light given by these units, it is an easy matter, in alternating-current plants, to adopt the low-voltage tungsten lamp of ten candlepower or less for switchboards. Where the lamps are placed directly over the instrument dials and are not used for general switchboard lighting this plan may work out in the most attractive manner. The efficiency of very small carbon lamps is so poor that the substitution of the tungsten lamp

may easily mean one-fourth as many watts for the service, even allowing something for the trifling loss in the low-voltage transformer necessary to supply the low-candlepower tungstens with the proper potential. Another advantage of the low-voltage tungsten lamp is the thickness of its filament, which means increased life and perhaps better service on panels where there are frequent shocks, as by the opening of heavy circuit-breakers. An examination of a switchboard in an industrial plant recently visited showed that probably thirty out of a total of forty-three panels could be equipped with the 110-volt, twenty-candlepower tungsten lamp without the slightest danger of premature breakage on account of vibration. The tendency of station designers to remove all heavy circuit-opening apparatus from the main switchboard makes the conditions still more favorable for the tungsten lamp. The tantalum lamp, at two watts per candlepower, also offers the switchboard panel improved illumination at reduced cost, if desired. On a large board it will easily be possible to save $10 or $15 per year by the substitution of tungsten lamps for carbons, not figuring anything more than the mere cost of delivering current at the bus. If the actual marketable value of the energy saved is considered, and this should be the case, the tungsten lamp will save $50 to $75 a year on a large board with very little trouble.

ELECTRIC COOKING.

Electricity has not only invaded nearly every department of industry, but it has invaded the household also, and a residence which is not supplied with current cannot be considered modern.

The use of small motors for driving all sorts of small domestic machines is increasing rapidly, and the use of heating devices, such as irons, toasters, etc., makes steady progress. In all of the heating appliances thus introduced, it is the element of convenience which has been paramount in determining their use. This is becoming more and more realized every day, and is one of the principal factors which decide in favor of the electric appliance.

If electric apparatus for general cooking is to make headway, it must be upon the same consideration. Fuel cannot compete with current on the basis of cleanliness, directness of application and general convenience. And if properly applied, the quality and uniformity of the product should be improved by the use of current.

The quality of most food is greatly improved by long cooking at low temperature, as contrasted with rapid cooking at a high temperature. There are exceptions to this statement, such as pastry, but it applies to nearly all meats, vegetables, cereals and fruits. The fireless cooker, aside from its convenience, is an advance in this direction, and an electric cooker which combined a steady supply of heat with the principle of heat insulation would represent a very close approach to perfection in the conditions of cooking. The convenience of being able to place food in the oven and leave it until wanted, with no danger of burning and with no limitations to personal freedom in the meantime, would far outweigh with any housewife the small question of cost, for this question is a very small one if all the heat generated is economically applied to its purpose.

In the design of cooking utensils the economical application and utilization of the heat should be one of the foremost considerations. With proper disposition of the heating units and the heat-insulating materials, the consumption of energy can be kept down to a figure where the cost is not prohibitive, and if the cost meets this requirement, the elements of convenience and performance will suffice for the rapid introduction of cooking apparatus. It is not necessary to actually meet the competition of fuel, if the other factors are made predominant.

AN ELECTRICAL RESTAURANT.

Electric stoves and cooking appliances are being made and sold in some quantity, but the fact is not especially noticeable to the "man in the street" as he patronizes his favorite restaurant down-town during the lunch hour. In certain exclusive clubs and restaurants the electric stove is used with much success, and its introduction has not caused the prices of meals to be advanced, even though the quality of the cooking has been notably improved. But, so far as we know, the popular-priced electric restaurant has yet to come.

It would seem that the introduction of a restaurant located in a prominent position and furnishing electrically cooked meals at popular prices would be a great advertisement for the use of electricity for cooking purposes. And the value of the scheme would be much enhanced if the kitchen were so located that it would be visible to passers-by. Besides the cooking there are other possibilities for electricity in the proposed establishment, such as dish washers, potato peelers, dough mixers, and so forth. People would patronize such a restaurant probably first from curiosity, and then, when its advantages over other places were established, from choice. Of course they would talk about it to their friends, and then many would begin to want the electric stove in their homes, and end by getting it.

The central stations might try this experiment themselves, or, at least, induce some up-to-date and go-ahead concern to introduce it. However, no matter who the pioneer may be, the central stations and the manufacturers of electrical apparatus would benefit, as would also the people who perforce have to take their mid-day or other meals in the city restaurants. Any restaurant introducing the electric stove and thereby gaining, say, only ten per cent more custom, would be an ultimate gainer even in cases where the cost of electricity is high compared with fuel.

Programme of Meeting of American Electrochemical Society.

The following papers have been announced for the eighteenth meeting of the American Electrochemical Society, to be held in Chicago, October 13, 14 and 15:

"Method for Determining Thermal Conductivity," by Carl Hering.

"The Electric Furnace and its Application," by Marcus Ruthenburg.

"Electrolytic Method of Producing Metals," by John W. Beckman.

"Reduction of Tin Dross in the Electric Furnace," by R. S. Wile.

"Notes on Triboluminescence," by W. S. Andrews.

"The Proximate Constituents of the Chemical Elements with Reference to Radioactivity and Electrons," by G. D. Heinrichs.

"Electrochemical Preparation of Calcium," by A. R. Johnson.

"Efficiency in the Electrolytic Preparation of Calcium," by F. C. Fray, H. R. Bicknell and C. A. Tronson.

"Electrochemistry of Polonium," by A. R. Johnson.

"The Present Status of Ozone," by R. D. Small.

"The Evolution of the Lead Storage Battery," by P. G. Salom.

"A New Secondary Cell," by W. S. Block.

"The Self-Discharge of Storage Batteries," by O. W. Brown and W. G. Bowers.

"Corrosion of Metallic Food-Containers," by Edward Gudeman.

"Electrolytic Corrosion of Metallic Anodes in Ammonia Solution," by A. W. Browne, M. E. Holmes and J. S. King, Jr.

"Electrolysis of Certain Solutions," by A. W. Browne and M. E. Holmes.

"Electrolysis of Some Cyanides," by H. E. Patten and W. R. Mott.

"Application of Electrostatic Separation to Ore Dressing," by F. S. MacGregor.

"The Isolation of an Ion and Measurement of its Charge," by R. A. Milliken.

"Crystallization through Membranes," by J. H. Walton, Jr.

"The Relative Basicity of the Metals," by L. Kahlenberg.

"The Effect of Water in Causing Chemical Reactions," by David Klein.

"The Physical and Magnetic Hardness of Some Electrolytic Iron Alloys," by James Aston.

The sessions will be held at the Congress Hotel and at University of Chicago. Visits have been arranged to the Western Electric Company, Commonwealth Edison Company, Automatic Electric Company, Hoskins Manufacturing Company, Chicago Telephone Company, Illinois Steel Company and Gary Steel Works.

Convention of the American Street and Interurban Railway Association.

As already announced, the twenty-ninth annual convention of the American Street and Interurban Railway Association will be held at Atlantic City, N. J., October 10 to 14. Every effort is being made by the officers to have a successful convention, and present indications are that nothing will be lacking. Special hotel and transportation rates have been secured.

There are a number of affiliated societies meeting with the Association, and each of these has sent out an enormous postal card setting forth the reasons why it will be advantageous to attend the convention.

The headquarters of the main body and of the Manufacturers' Association will be at the Marlborough-Blenheim Hotel. The Accountants will have headquarters at the Chalfonte, the Engineers at the Dennis, while the Traymore will be headquarters for the Claim Agents and the Transportation and Traffic Association. H. C. Donecker is secretary of the latter, as well as of the parent body; H. E. Weeks is secretary of the Accountants' Association, John W. Corning of the Engineering Association. The notice for the Claim Agents' Association is issued by E. C. Carpenter, president.

The meetings will be held and the exhibits displayed on Young's new pier.

Motor Specifications for the Navy.

In order to establish uniformity in motors and other electrical apparatus used on board ships of war, a conference was recently held in Washington. Representatives of various bureaus met with manufacturers' agents and prepared new specifications.

It has been found that these conferences between the departmental officials and the business people are of great practical value. They enable the authorities to determine commercial customs.

International Tramways Congress.

The sixteenth International Tramways Congress was held at Brussels, Belgium, during the week beginning September 5 last. There were many papers presented and discussed. A brief report of some of these follows:

Central Station:—M. Thonet, Liége, Belgium, recommended producer-gas engines in cases where coal is dear (from about $3.00 to $4.00 a ton), especially for powers not exceeding 500 or 600 horsepower.

Meters.—The Congress recommended current meters as a means for increasing the efficiency of motormen and reducing current consumption.

Rail Cleaning.—M. Schorling, Hanover, Germany, described an electrical apparatus, used in Cologne, Germany, which cleaned 160 kilometers of track in two days of twelve hours each. He stated that large sums were being expended by street-railway companies for track cleaning, and that mechanical methods are superseding hand labor in this connection.

Overhead Wires.—M. Otto, Berlin, Germany, collected statistics of 110 street-railway companies, of which seventy-five use wheel trolleys, thirty employ the bow trolley, three use both of these systems, and two the Dickinson system. Galvanized steel wires are used in the majority of cases for suspension wires.

An Artificial Daybreak.

One of the features of the opening of the New York Electrical Show, which will be held in Madison Square Garden, October 10-20, will be a lighting effect arranged to simulate dawn.

After the garden has been filled the outer doors will be temporarily closed, and at a given signal all the electric lights will be extinguished simultaneously. After a few seconds of deepest darkness, it has been arranged to have one yellow light twinkle out from the eastern "sky," followed by another and another, until the east end of the garden takes on the appearance of dawn. Gradually the lights will show until the whole hall is again illuminated.

Electric Furnace Development.

An electric steel furnace has been installed by the Noble Electric Steel Company at Heroult, Cal., and is reported to be giving satisfaction.

Charles L. Edgar.

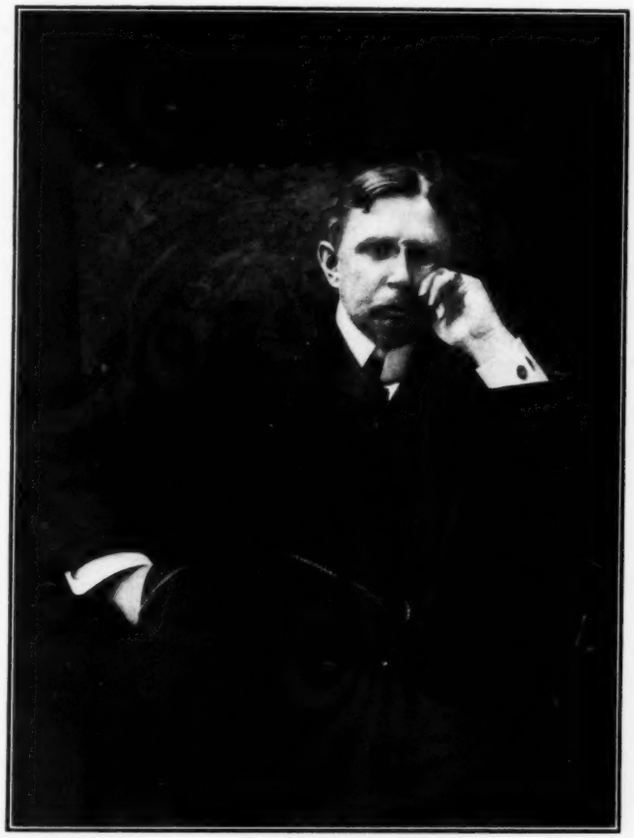
The central-station industry in this country owes its strong position at the present time in no small measure to the far-reaching influence of its pioneers. Fortunately there are still left many of these pioneers and their steady devotion to the industry has placed them in its leading positions. In several of our large cities we find at the head of the central-station company men who received their apprenticeship in the first Edison electric light plants and who passed through all the varied experiences of the evolution from those small beginnings to the great engineering and commercial achievements of the electrical industry of today.

Charles L. Edgar, of Boston, is one of the best known of these pioneers. Since his college days he has been steadily identified with the electrical industry and for over twenty-three years he has directed the growth and destinies of electric service in Boston. His career is a fine example of the success that may be achieved by an engineer when placed at the head of a great undertaking.

Charles Leavitt Edgar was born December 23, 1860, at Griggstown, near Princeton, N. J., his parents being Thomas and Annie Edgar. After an early training in the local schools he prepared himself for entrance to Rutgers College, from which he was graduated with the degree A. B. in 1882. He then took up some post-graduate work in electricity under Prof. F. Cuyler Van Dyck and for this and subsequent practical work he received from Rutgers College the advanced degrees A. M. in 1885 and E. E. in 1887.

Having frequently visited relatives at Menlo Park near his old home, he became imbued with the desire to associate himself with the work of Thos. A. Edison and in January, 1883, he applied for an appointment. He was sent to the old Edison Machine Works in New York City, where he was employed for nine months. For a time he was transferred to the factory of the Bergman Company, which manufactured central-station apparatus. He then became connected with the Edison Electric Light Company at its original factory in New York City, and remained in its service until 1887 when he had risen to the position of chief engineer. During these years his work was of a general engineering character, particularly installing small central stations throughout New York and adjoining states.

In August, 1887, the parent Edison company sent Mr. Edgar to Boston as superintendent of the Edison Electric Illuminating Company of Boston, which had been organized the year before. He has remained continuously with this company, rising successively through all the highest executive positions. In 1889 he became general manager, which position he still holds. Shortly afterwards he was made vice-president and on the death of Jacob Rogers in 1900 he was chosen president of the company.



CHARLES L. EDGAR,
President and General Manager, Edison Electric Illuminating Company of Boston.

Mr. Edgar has personally taken a keen interest in keeping his company among the leaders in central-station practice. He has made numerous trips to Europe to study at first hand the methods in vogue in the largest electric plants. As a result of these investigations he early saw the value of storage batteries as central-station auxiliaries and imported for use in Boston a Tudor battery from Germany, which was the first battery used in this service in this country. He also foresaw the need of compact generating units for stations in congested districts and installed at Boston, the first vertical engines for central-station work in America. On a special visit to England in 1898, he studied the Wright demand system of charging and introduced it on the Boston Edison service. In all cases he has had adopted by his company the most up-to-date engineering and commercial practices that were adaptable to the conditions in his city. From small beginnings the service of the Boston Edison Company has been extended under Mr. Edgar's direction so that now it covers practically the entire metropolitan and suburban districts besides many neighboring cities and towns, and has one of the largest connected loads in this country.

One of the features that has contributed to the great success of the Boston Company is its highly developed welfare work. Mr. Edgar has personally interested himself in the formation of the Edison Employees' Club, whose success gave impetus to similar clubs and later company sections of the National Electric Light Association in other cities. The educational and entertainment features of the Boston club have served as models for other clubs.

Mr. Edgar has always been prominently identified with the leading central-station associations and engineering societies. He was president of the Association of Edison Illuminating Companies from 1893 to 1895. After being three times vice-president of the National Electric Light Association, he was elected its president in 1903. He has also been president of the Massachusetts Electric Light Association and chairman of the Boston Section of the American Institute of Electrical Engineers.

Annual Meeting of Sons of Jove.

The eighth annual meeting of the Rejuvenated Sons of Jove will be held on October 13, 14 and 15, 1910, at Birmingham, Ala., this being the home of the reigning Jupiter, Oscar C. Turner. Birmingham has a Jovian membership of about one hundred, and every one of these members is thoroughly active and interested. They promise all visiting Jovians three live days. Special preparation has been made for the entertainment of the ladies. The Alabama State Fair will be in full swing at Birmingham during the convention. A special opportunity will be afforded to visit Chattanooga, Lookout Mountain, Missionary Ridge, the National Cemetery and the old battlefields that have made that part of the South doubly historic.

The Sons of Jove is a fraternal order of electrical men throughout the United States, Canada and Mexico. It has now a membership upwards of four thousand and is growing rapidly. During the past year the membership has been increased by over one thousand members in all parts of the country. The object of the order is frankly commercial. It aims to bring about a greater degree of harmony and cooperation among those engaged in the same line of business by getting into closer contact all branches of the industry. It strives to eliminate petty jealousies, unfair methods of competition and elements of friction; to increase the common market by cooperative advertising. Its slogan is "All together all the time for everything electrical."

The officers, known as the Jovian Congress, are as follows: Jupiter, Oscar C. Turner; Neptune, J. F. Dostal; Pluto, F. M. Bernardin; Vulcan, J. A. Campbell; Mercury, R. M. Van Vleit; Hercules, W. W. Lovell; Mars, H. V. Carter; Apollo, J. A. Vaughan; Avrenim, T. A. Burke.

Railroad Men See Pennsylvania Station.

A party of railroad officials from the West, Southwest and South recently inspected the new Pennsylvania Railroad station and tunnels in New York. Parties left Chicago, St. Louis and Cincinnati, uniting at Pittsburg.

Among the visitors were C. A. Cairns of the Chicago & Northwestern Railway, P. S. Eustis of the Burlington, L. M. Allen of the Rock Island, S. C. Warner of the Kansas City Southern, C. L. Stone of the Missouri Pacific, C. S. Crane of the Wabash, H. F. Cary of the Southern, W. B. Bevill of the Norfolk & Western, and L. S. Hungerford of the Pullman Company. They were met by Samuel Moody and J. R. Wood and other officials of the Pennsylvania lines, and the new station from the practical railroader's point of view was explained to them.

Afterward they were entertained at luncheon at the Waldorf, where informal speeches were made and the visitors expressed their pleasure at what they saw and their appreciation of the immense improvements which had been effected.

Illinois State Electrical Association.

The annual meeting of the Illinois State Electrical Association will be held at Rock Island, October 25, 26 and 27. An interesting programme has been prepared and this will be supplemented by a comprehensive electrical show given by supply houses and manufacturers.

For the purpose of popularizing this exhibition the People's Power Company, of Rock Island, has been advertising extensively in Rock Island and the neighboring towns. The company has, together with the manufacturers, arranged for a display of electrical goods. V.

Membership of Illuminating Engineering Society.

The Membership Committee of the Illuminating Engineering Society, consisting of J. R. Crouse, H. B. Dates and W. H. Gartley, has wound up its whirlwind campaign and made a report to Secretary Millar showing that 500 applications have been received. This represents an increase in the membership of the Society of about fifty per cent.

The increased annual revenue of the Society will amount to $2,500. The cost of the campaign has been over $1,200.

Telegraph Operators Get More Pay.

Telegraph operators on the Monon Railroad recently received announcement of a nine-per-cent raise in wages, which became effective September 1. The operators also obtained other concessions, their organization, the Order of Railway Telegraphers, receiving official recognition for the first time.

Sanitary District Report.

The report of the Chicago Sanitary District for the first six months of the current year shows a gross income of $258,327, an increase of 55.5 per cent over last year. The operating and maintenance expenses, including $35,686 for depreciation, amounted to $113,796, making the net earnings $144,531. The rental on leased lines brings this down to $144,284.

The cost of the plant and equipment is $4,267,614, so that the returns represent 6.8 per cent on the investment.

Trade Co-operation.

Consul-General John L. Griffiths, London, England, writes that inquiries have recently been made at his consulate-general for the names of local representatives of various products of American manufacture. In some instances it has been possible to give the desired information without delay, but in other cases it has taken considerable time to verify the fact as to whether or not this or that article of American manufacture was handled in London. As the result of such inquiries it appears that it would be greatly to the benefit of the American manufacturer in general, and in particular, if in establishing a foreign branch or in employing a foreign representative he would notify the American consul situated in that place. In this manner the consulate would be, as it ought to be, a local clearing house for the extension of trade in American-made products.

Electrical Machinery Exported.

The electrical machinery exported during the eight months ending with August, was valued at $4,100,000. For the corresponding eight months of the previous year the amount was $4,800,000.

To Extend Union Railway.

In the case of the Lorain Steel Company against the Union Railway Company of New York, an order was recently issued authorizing Frederick W. Whitridge, receiver, to spend part of the funds of the Union Railway Company. With the $65,000 which is to be expended an extension is to be built to the Bronx.

An Electrically Equipped Stone Quarry.

A Description of a New and Comprehensive Plant at McCook, Ill.

Near McCook, Ill., about sixteen miles southwest of Chicago, in a territory known for its stone production, there is located the new stone-crushing plant of the United States Crushed Stone Company, Chicago, which has recently been put in operation. This plant, which is believed to be one of the most complete of its kind, was constructed to supplement one already in existence on the same site, as the original plant was deemed inadequate to supply the increasing demands for crushed stone. Situated on the Santa Fé, Baltimore & Ohio, Indiana Harbor Belt and Chicago Terminal railroads, the Company is enabled to make prompt deliveries direct to Chicago and southern lake ports.

GENERAL VIEW OF QUARRY, UNITED STATES CRUSHED STONE COMPANY, McCOOK, ILL.

The United States Crushed Stone Company owns at the site a tract of land covering about 300 acres, of which fifteen acres are being worked. A majority of the tract, however, is available for quarrying purposes. The quarry opening is 1,700 feet by 300 feet. The company has now reached a forty-foot face and is working to reach a forty-foot level. The stone quarried so far has been found quite uniform in character and has only a slight overlay of earth. It is quarried very readily and can be handled and crushed in a satisfactory and economical manner with the present equipment. The plant is operated both day and night and turns out about 6,000 tons of commercial rock per day.

The buildings of the plant are constructed of concrete and structural steel. They are located in a row with the quarry the northern extremity. The output of the quarry is delivered to the roll house and is then passed through the remaining buildings to the loading point for shipment.

The entire mechanical equipment of this plant is operated by electricity. All large machines are operated by individual motors and the smaller machines are group-driven from line shafts belted to the motors. The total load of the plant when in full operation is 3,400 kilowatts.

Power is purchased from the Sanitary District of Chicago, connections being made from the latter's substation at Thirty-first Street and Western Avenue.

Sixty-cycle, three-phase current at a pressure of 12,000 volts is received at

the substation at the plant and is passed through step-down transformers which reduce the pressure to 440 volts for local distribution.

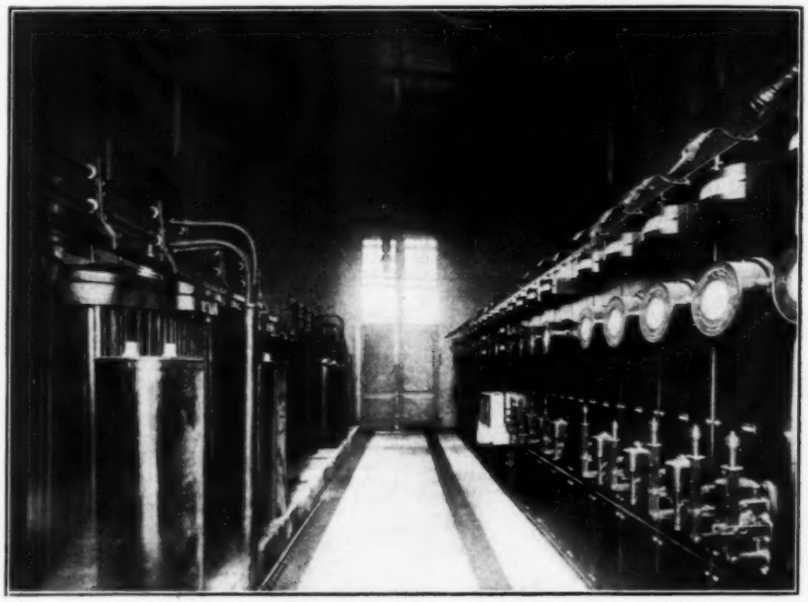
The power and substation building, forty-three feet by twenty-eight feet by twenty-four feet, is a brick structure of concrete foundation and trimmings with a gravel roof. The equipment in this station comprises six step-down transformers, a switchboard and lightning protective apparatus. All electric power and lighting circuits throughout the plant are controlled from this switchboard. Each section of the plant is controlled from a separate panel on which are mounted integrating wattmeters that keep a continual check on the amount of power consumed by the different sections. The switchboard is also equipped with ammeters, voltmeters and circuit-breakers of the most modern types.

Current is delivered from the substation to the different buildings in three-conductor lead-covered cables placed in vitrified ducts laid underground the full length of the crushing plant. Manholes are placed at each section of the plant, so that branch connections may be made to distributing cabinets within the buildings. From these cabinets a separate supply feeder delivers power to each motor.

The plant is lighted throughout by arc and incandescent lamps, the current for lighting being stepped down by transformers, in each building, from 440 to 120 volts. Arc lamps are provided about the grounds and in the quarry, in order that operations may be carried on at night. These lamps are supplied with current direct from the substation and are entirely separate from the lighting circuits within the buildings.

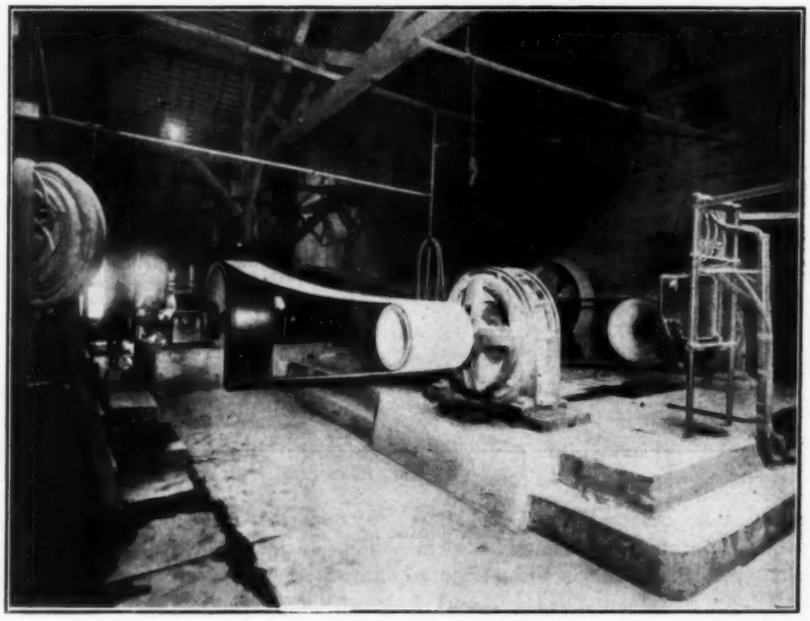
The first process in the operation of the plant is the loosening of stone around the quarry. This is accomplished by first drilling holes of a sufficient depth and then dynamiting these holes, in this manner loosening great quantities of stone at a single blast. Two methods of drilling are employed, one by means of compressed-air drills and the other by means of electric drills.

In the former method the regular automatic-feed Ingersoll-Rand rock drills mounted on rectangular frames are used. They are self-contained and are arranged to be moved as a unit. For supplying the air a motor-operated Ingersoll-Rand air compressor is used, which delivers into a receiving tank. A pipe line, extending entirely around the edge of the quarry, is run from this tank and fitted with valves so that connections can be made at any point where operations are being carried on.



INTERIOR OF SUBSTATION AT McCOOK, ILL.

The Company, however, has installed two electric drills, known as blast-hole drills, which have given such economical and efficient service that additional ones have been ordered to entirely replace the air drills. A view of two of these drills is shown in one of the accompanying illustrations. The drill consists of a ten-horsepower motor belt-connected to a shaft operating a walking beam, which alternately raises and lowers the bit of the drill. The drill bores a hole six inches in diameter and fifty feet deep.



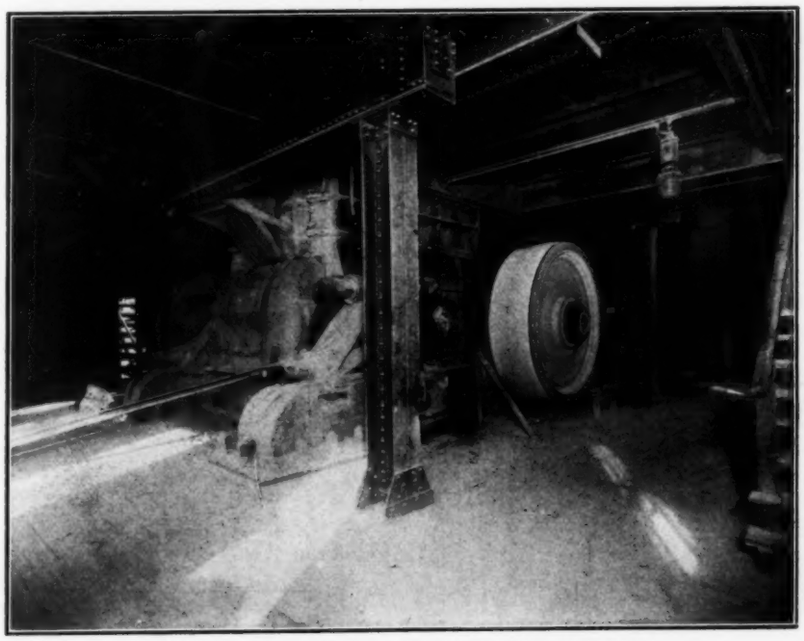
MOTOR-DRIVEN AIR COMPRESSOR.

It is stated by the officials of the United States Crushed Stone Company that three of these drills are equal to ten of the compressed-air type in the

matter of work. By reason of drilling a hole of greater depth and larger diameter with a noticeable saving in cost of operation it is said that their use has effected a saving of ninety per cent.

TWO OF THE MOTOR-DRIVEN DRILLS.

In the quarry to handle this stone there are one Atlantic and two Bucyrus 110-ton steam shovels. The latter have a dipper capacity of 3.5 cubic yards. These steam shovels load the stone into cars, which were especially designed for this quarry. The cars are standard-gauge flat cars, which carry a steel skip of a capacity of ten cubic yards. These skips are open on one side to facilitate quick dumping.



MOTOR-DRIVEN EDISON ROLLS FOR CRUSHING STONE.

Three sixteen by twenty-two saddle-tank locomotives are used in the bottom of the quarry for switching these cars, in trains of six each, to the foot of the incline leading to the roll building. From this point they are hoisted by means of a 300-horsepower Lidgerwood electric hoist, into the roll-house building. The skips are dumped into the upper hopper of the roll by means of an electric hoist, which slides the skip off from the car platform on to the skip table, and tilts the skip until the contents are emptied into the rolls. The same hoist returns the skip to the car platform.

The rolls rest on two large girders, supported by a substantial concrete foundation, on which girders the housings carrying the rolls proper are mounted, and are so arranged that the housings can be moved along the girders, in order to regulate the size of the crushed product.

The rolls consist of shafts, on which are pressed and keyed steel mandrels, octagonal in shape, to which are keyed and bolted eight chilled-iron slugger plates to form a circle. These slugger plates are cast with large knobs, which protrude for the purpose of breaking the rock as it is fed to the rolls. Each roll weighs approximately fifty tons and is seven feet long and six feet in diameter. They are driven independently by electric motors of 250 and 200 horsepower respectively, and revolve at the rate of 170 revolutions per minute.

These giant rolls are the invention of Thomas A. Edison. The principle on which the crushing is done is by impact and speed, and there is not in any way a crushing action. At the high speed at which these rolls revolve, the stone strikes the sluggers and is hurled with such impact against the opposite roll and back again that it is easily shattered. It is possible to crush any size stone in these rolls that can be picked up by the steam shovel, up to and including single pieces weighing as much as seventeen tons, requiring less than half a minute to reduce these large rocks to sizes of five inches and under.

After the stone passes through the rolls it drops into a lower hopper, which has a capacity of forty cubic yards, and from there is loaded on a retarding roll and into two skip cars of fifteen-tons capacity each. These cars are run up a steel skipway 210 feet long and built on an incline of forty-three degrees, and are discharged into a bin of forty yards capacity which is located at the top of the steel structure 135 feet high. The electric hoist which handles these cars is of 300-horsepower capacity and was built by the Lidger-

wood Manufacturing Company. It operates at a speed sufficient to enable the skip car to discharge into the tower bin at the rate of one car per minute.

The rock from this bin is then distributed to two revolving screens seven feet in diameter and twenty feet long, which allow all stone crushed to three inches or under to pass through, and which reject all stone over three inches in size. The undersized stone is carried directly by means of a motor-operated belt conveyor to a forty-eight inch by twenty-four inch revolving screen, and is at once distributed to the commercial bins. The rejections are discharged half to the No. 8 Gates crusher and half to two No. 6 McCully crushers. The stone is there reduced and elevated to screens and sized for commercial purposes.

In addition to this equipment there are also two No. 5 and two No. 4 McCully crushers used for further reduction, also a set of Power and Mining Machinery Company's crushing rolls which are said to have a capacity of about four of the ordinary type of gyratory crushers. The two rolls of this crusher are operated independently by two fifteen-horsepower motors. The No. 8 crusher is motor operated and is fed by a motor-operated pan conveyor.

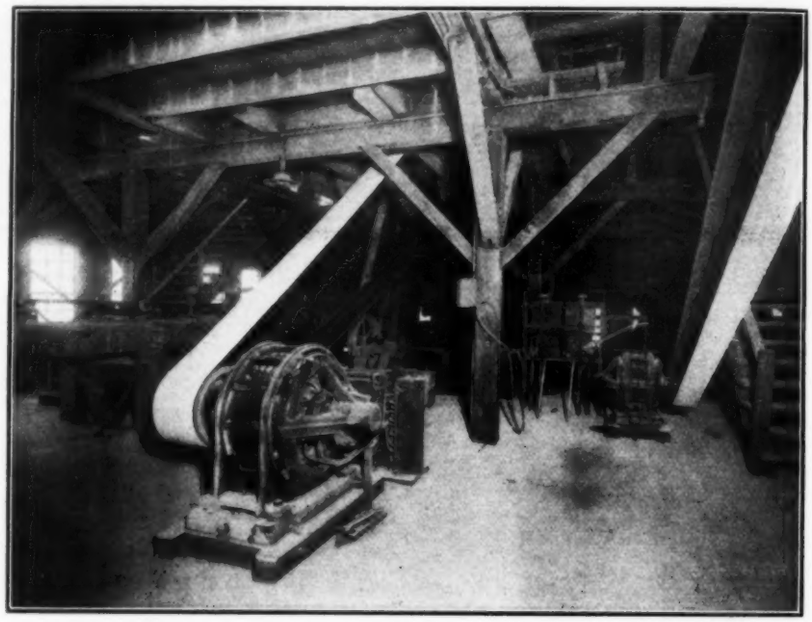
In the event the Edison rolls are fed with rock beyond the capacity of the other crushing equipment, the company has provided a storage bin to receive discharges from the large screens. The capacity of this bin is 1,000 cubic yards and it is so arranged that the stone can be taken away from the bottom discharge gate on to a pan conveyor to an elevator, discharging into the No. 8 crusher. This enables the company to operate one-half of the plant during the night, and re-crush this accumulation with a minimum number of employes.

The following is a list of the machines installed at the McCook plant and the sizes of the motors which operate them:

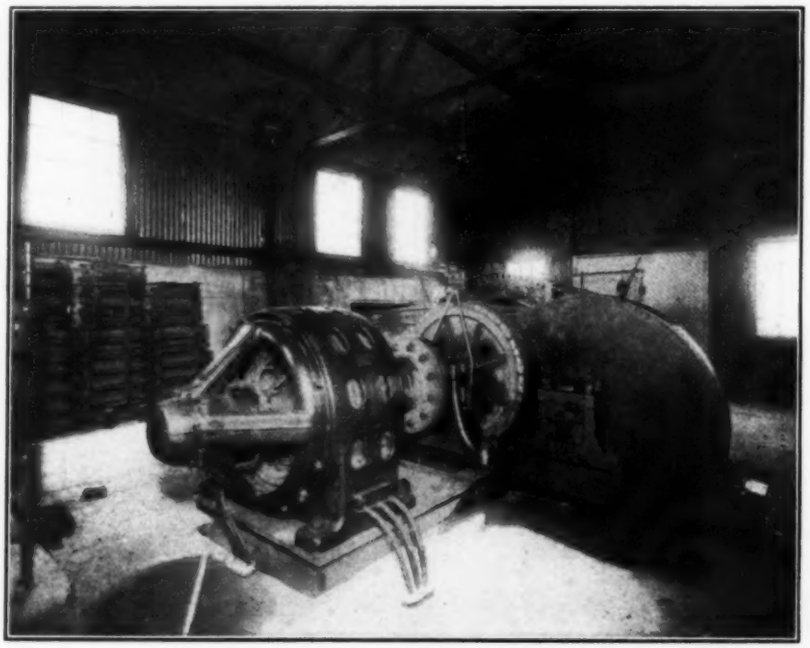
Machine—	Horsepower of Motor.
Well Drill	10
Well Drill	10
Air Compressor	150
No. 8 Plant	200
No. 12 Skip Tower Feed Rolls	10
No. 14 Primary Screen	30
No. 17, No. 6 Crusher	40
No. 19, No. 4 Crusher	20
No. 15 Conveyor and Screens	85
No. 20 Pan Conveyor	15
No. 11 Skip Tower Feed Rolls	10
No. 13 Primary Screen	30
No. 16, No. 6 Crusher	40
No. 18, No. 4 Crusher	20
No. 10 Skip Hoist	300
No. 7 Quarry Hoist	300
No. 3 Upper Feed Roll	15
No. 4 Tower Feed Roll	15
No. 6 Oil Pump	2
No. 9 Auxiliary Hoist	37.5
No. 2 Plain Roll	200
No. 1 Slugger Roll	250
No. 8 Quarry Hoist	300
Pumps	75
Elevator and Pan Conveyor	85

The electric plant is lubricated by a gravity system, having a distributing tank at the top of the mill. The oil is piped to all bearings, throughout the plant, and drained into a large filter tank on the ground. It is then filtered and returned by means of a centrifugal pump, operated by a two-horsepower motor, to the original distributing tank at the top of the building.

Although the fire risk at this plant is minimum, owing to the construction of the building and the nature of the product handled, a complete protective equipment in the form of a comprehensive system of high-pressure piping has been installed. This system is supplied by high-pressure pumps located about the plant, direct-connected to motors aggregating seventy-five horsepower.



MOTORS FOR OPERATING CONVEYORS.



ELECTRIC HOIST FOR OPERATING SKIP CARS.

The crushing machinery with the ex-

ception of the Edison rolls and the Gates crusher was supplied by the Power and Mining Machinery Company, Cudahy, Wis. The latter was furnished by the Allis-Chalmers Company, Milwaukee, Wis. All of the motors used throughout the plant were furnished by the General Electric Company, Schenectady, N. Y.

The switchboard, which consists of twenty-five panels, was supplied by the Western Electric Company, and the transformers in the substation by the Pittsburgh Transformer Company. The Edison rolls were supplied by the Edison Crusher Roll Company, Stewartsville, N. J.

The United States Crushed Stone Company is starting operations on a complete stone-washing plant, which will be equipped to wash stone for special concrete work.

Special Lighting for Conservation Congress.

In connection with the recent American Conservation Congress held at St. Paul, Minn., there was a special electrical illumination of streets and public buildings that attracted much favorable notice from the numerous visitors from all parts of the country. It is estimated that 500,000 incandescent lamps were used in this illumination in the twin cities. Although the lighting was chiefly confined to St. Paul, Minneapolis took a generous part. Among the buildings most attractively outlined were the Capitol and Court House, which glistened in the darkness. For the street lighting, arches with a distinctive circle at the center were used and the installation of these along Fifth Street made a particularly imposing appearance. The brilliancy and beauty of the entire effect made a great impression on the visitors and drew from them expressions of genuine praise.

Examination for Electrician Helper.

The United States Civil Service Commission announces that an examination will be held at the usual places on October 19, to fill vacancies in the position of electrician's helper. The entrance salary is $600 per annum.

Those interested should apply to the United States Civil Service Commission, Washington, D. C., or to the secretary of any board of examiners for Form 1800.

COLORADO ELECTRIC LIGHT, POWER AND RAILWAY ASSOCIATION.

ANNUAL CONVENTION AT GLENWOOD SPRINGS.

The eighth annual convention of the Colorado Electric Light, Power and Railway Association was held at the Hotel Colorado, Glenwood Springs, September 21, 22 and 23.

The first session was called to order at ten o'clock on Wednesday morning, and listened to the address of the president, William T. Wallace.

The first paper to be presented was one by H. L. Aller, of Denver, on "Mazda Street Series Lighting," of which an abstract follows:

MAZDA STREET SERIES LIGHTING.

In the mountain section of the country the winding and hilly streets are peculiarly suited to lighting by small units closely spaced. As the series tungsten lamp is best adapted for this service, Mr. Aller describes the constructive and illuminating features of the Mazda series lamps, illustrating many of these types. The filament is a simple thick V-shaped loop, except for the largest sizes. The tip of the filament is anchored with a molydenum spring of great elasticity. The ends of the filament are welded to the leading-in wires with a fused-ball joint, overcoming the former tendency to break at these points. A table of ratings is given in the paper. The rated life is conservatively placed at 1,350 hours, although many of these lamps have averaged 4,300 hours. A new shellaced-film cut-out is used in the socket, which is also provided with a short-circuiting spring contact. A new form of constant-current transformer has been developed which has 100 per cent maximum reactance so as to be capable of giving zero regulation. Radial wave reflectors are generally used with series tungsten lamps and many attractive forms of bracket fixtures are now on the market. Mr. Aller showed views of several decorative lighting installations using clusters of tungsten lamps. While multiple lamps are generally used for this purpose, the series type is also adapted to this end and has been so used at Gary, Ind. With gas at $1.00 per 1,000 cubic feet, the tungsten lamp can easily compete with Welsbach mantle gas lamps and still produce a revenue of 10.9 cents per kilowatt-hour. Fifty-watt lamps give better illumination than the so-called fifty-candlepower mantle lamps. Series tungsten lamps can even be used to advantage to replace the alternating-current enclosed arcs. In western cities these are commonly placed every second block or about 1,000 feet apart. Four 100-watt tungsten lamps could be used in place of one 6.6-ampere arc, thus placing the lamps 250 feet apart and giving a much better light distribution at the same total cost.

There followed a number of interesting papers, as follows: "Some Observations in Cultivating Friendly Relations with the Public," by J. M. Connelly, of Denver; "Notes on Distribution Pole Lines," by J. C. Lawler, of Colorado Springs; "Creosote Treatment of Our Native Lodge-Pole Pine Poles," by George R. Ogier, of Denver; "The Place of Rotary Condensers and Induction Generators in Transmission Systems," by A. L. Jones, of Denver; "Steam Turbines," by E. M. Gilbert, of Denver. There was quite a free discussion of these papers, abstracts of which follow.

CULTIVATING FRIENDLY RELATIONS.

This paper sets forth an earnest plea for more friendly relations between central stations and the public, setting forth the great advantages to be derived therefrom. The attitude of a company's employees is one of the most essential qualifications conducive to friendly relations. The paper points out how it is vastly more probable for a central-station company to obtain an exclusive and longer-term franchise from a city by taking the public into its confidence in all matters and explaining why competition would not result in lower rates. A good share of the paper is devoted to the various phases of journalism as it relates to the central-station industry. The author, in addition to advocating the liberal use of advertising space, points out that the press is always willing to publish material having a news value and instead of ignoring this opportunity of obtaining publicity, central stations should avail themselves of this valuable opportunity to explain their position to the public.

DISTRIBUTION POLE LINES.

Pole lines for light and power distribution circuits seldom receive proper attention during construction. Mr. Lawler contends that they are as important as transmission lines and should be laid out and erected with as much care. Material for pole-line construction has not been improved much lately and generally is mechanically weak. The use of duplex wire for services is desirable. Improved service pole and tree insulators and self-supporting poles are needed. Insulators should be standardized to a few general types. It is false economy to build cheap lines. Increased length of spans mean greater maintenance; 100-foot spans are best. Poles should be placed on lot lines extended and preferably in the alleys; they should be straight, well in line, and painted. Galvanized hardware is best. Brackets and eccentric crossarms are not desirable construction. No. 6 wire is the smallest that can be used. Each house should have a separate service. Transformer records should be kept in a card index. Line maps should be carefully drawn, cut up into convenient form and filed for reference. Primary and secondary lines should never run on the same cross-arm. Lightning-arresters should not be put on the same pole with transformers or fuses. Three-wire secondaries are not advisable in residence districts, as they generally are unbalanced on the three legs of the circuit. If transformers are connected in parallel, each block should have its individual set of transformers and all should be fused at one point. In a business district the problems of secondary distribution are more complex; several different kinds of current must be furnished; lines of other companies hamper the arrangements. A company should furnish a few standard voltages to all parts of each block, instead of handling each case separately; the latter leads to a complicated network of lines and poles. Mr. Lawler concludes his paper by describing a standard construction adopted in a business district. Bridge construction with three cross-arms spanning the alley was used and this provided for all the various classes of service. Three single-phase

transformers with 110-220-volt secondaries are provided for each block and connected across the three legs of the three-phase supply. The system amounts to a double three-wire system and gives either 110 or 220 or 110-220-volt single-phase, also 110 or 220-volt three-phase distribution. Joint use of this pole line is provided for other companies and the city service. Such systematizing of the pole line construction and distribution system permits a neat construction with a minimum number of poles and wires and ties up the least investment.

CREOSOTE TREATMENT OF POLES.

At the beginning of his paper Mr. Ogier showed that wood preservation is an old art, having been first used about 1705. In tracing its development to the present, it was stated that creosote treatment was not used until about 1874, but has been rapidly extended since then. The United States Forest Service has taken an active interest in it as a means of conserving the lumber supply. An experimental plant erected by the Service at Norris, Colo., was purchased by the company with which Mr. Ogier is connected. The open-tank creosote process is used and the butt ends of the poles only are treated. The native lodgepole pine timber has a life of only five years if untreated, but of twenty years when treated with creosote. The cost of untreated cedar and other high-grade poles brought to Colorado is as much as that of the treated native poles and the life of the latter is greater. A table of the life of various treated timbers shows that it varies between twenty and thirty years and that this is from twice to four times the life of the untreated timber, depending on the species. The financial saving in this country from consistent preservative treatment of all timbers would be about $72,000,000 annually and that from the treatment of poles alone would be $2,880,000 per year. In many cases larger poles are used than are really needed in order to make allowance for future decay. Preservative treatment overcomes this waste and prolongs the life of the durable species in use. It also enables the utilization of cheaper and inferior woods, which without treatment would have little or no value.

ROTARY CONDENSERS AND INDUCTION GENERATORS IN TRANSMISSION SYSTEMS.

The ability to operate a synchronous motor at a power factor under the control of the operator makes it a most useful adjunct of a transmission system. The influence of induction motors and other inductive loads in lowering the power factor is being felt more and more as a system is loaded up. When running light an induction motor takes as much magnetizing current, that is almost entirely wattless, as when loaded. This must be supplied by the generators at the expense of useful capacity, because the output of a generator is limited to the current it can carry without injurious heating. Thus a generator operating at seventy per cent power factor can deliver only seventy per cent of its total capacity and thirty per cent of its possible output and that of its prime mover is unavailable. By operating an overexcited synchronous motor on the line the wattless magnetizing current for the inductive load can be supplied by it and the power factor of the line raised so that the generators can give nearly their maximum output. A synchronous motor operating this way is called a rotary condenser and takes very little power from the line. It supplies the magnetization for the inductive load more cheaply and better than the main generators. Rotary condensers should be installed near the center of the load district, so that they relieve not only the generators, but also the transmission lines and transformers of the wattless current. Such machines can also drive a mechanical load without greatly reducing their capacity as condensers. They can drive mechanical load up to seventy per cent of rating without diminishing the condenser action to below seventy per cent of the capacity to supply magnetizing current to the line. Respecting the use of induction generators, Mr. Jones first described their characteristics. They cannot deliver leading or lagging current and can only supply power current to a circuit that can provide them with wattless magnetizing current. They cannot supply current to a short-circuit. The charging current of a large cable system would supply part of the magnetizing current for induction generators, but this magnetizing current has to be very heavy, which is one of the serious drawbacks to these machines. Their most promising field is in connection with high-speed turbines and gas engines as well as waterwheels. However, they cannot very well constitute over one-third the total generating capacity of a system so that their good effects are minimized. Hence, despite their simplicity of construction and operation, there has arisen practically no demand for their use.

STEAM TURBINES.

This paper is a brief treatise on the steam turbine, giving "a few general details, considering these machines as a separate and distinct class of prime movers." Following a brief historical introduction and a classification into types, a short theory without going into thermodynamics is given, with reference to certain well known designs. The advantages of turbines as compared with reciprocating engines are enumerated, as follows: (1) Reduction in space occupied and smaller foundations; (2) saving in oil; (3) absence of oil in condensed steam; (4) less vibration; (5) regulation; (6) simplicity; (7) less drop in economy due to age and efficiency of operators; (8) economy, especially with load fluctuating heavily. A discussion of these points separately follows. Results of these taken from cited authorities, with brief remarks on economical working, a few paragraphs on the low-pressure turbine, and a brief reference to the mixed-pressure type, conclude the paper.

One of the most important things taken up by the convention was the very complete report of the Meter Committee. This report was prepared for the purpose of placing before the members of the Association, all details incident to the manufacture, construction and operation of all makes of meters, for each and every class of service, in order to show the people methods to be adopted by the various central-station men in receiving and distributing these meters, installing them, testing them, and the records incidental to the above. The Meter Committee went into detail in regard to the manner in which meters were to be installed, and the manner in which the company should protect same. The meter should be so installed as to fully protect the company from any losses due to failure to meter the entire connected load of the consumer, or to intentional theft on the part of the consumer.

The method of grounding secondary distribution wires of lighting circuits was taken up in a complete manner by the Committee on Grounding Secondaries, an abstract of whose report follows. The committee consisted of J. A. Clay, G. L. Flower and W. A. Carter.

GROUNDING SECONDARIES.

This report records the experiences of the various companies who answered the list of questions submitted. Some results of tests on resistance of grounds made some years ago by E. E. F. Creighton are also given. One of the most important things brought out in the report is that there have been a number of serious accidents upon secondary circuits which were not grounded, whereas there have been none on the grounded circuits, and no increase in fires. One of the accidents required the amputation of arm and leg of an employee who touched the frame of a 440-volt, three-phase motor. Neither frame nor secondary circuit was grounded, and lightning had caused an arc from primary to secondary circuit. This leads the committee to condemn the ruling in the National Electrical Code that motors operating at 550 volts or less should be insulated from ground. It is also pointed out that conditions in Colorado are peculiar, owing to unsatisfactory ground resistances.

The Association recommended to its various members the grounding of secondary distribution wires wherever it was possible to obtain a good ground. It was also recommended that on strictly power circuits all transformer cases and some point of the secondary winding be grounded, and that the central-station operator should recommend to the consumer that the frames of motors and starting devices, conduit, etc., should all be well grounded.

A committee was appointed for the purpose of submitting data to the next regular meeting, covering the joint uses of poles by all companies, with recommendations concerning insulators, pole fixtures and the manner of treating poles so as to obtain the maximum life.

The following officers were elected for the ensuing year: president, H. L. Corbett, of The United Hydroelectric Company, Georgetown, Colo.; vice-president, John A. Clay, Animas Power and Water Company, Durango, Colo.; executive committee, Wm. T. Wallace, Geo. B. Tripp, J. F. Dostal. The secretary of the Association for the ensuing year will be appointed by the president.

Chicago Railways Company.

The Chicago Railways Company has rehabilitated 204 miles, or seventy-five miles more than the ordinance contract required by this time. About $500,000 is required to finish odds and ends. The Company has over $2,000,000 new-equipment contracts.

THE PACIFIC COAST ELECTRICAL EXPOSITION.

A FINE SHOW HELD IN SAN FRANCISCO, CAL., SEPTEMBER 17 TO 24, 1910.

The first Pacific Coast Electrical Exposition, held in the new Coliseum, San Francisco, Cal., from September 17 to 24 proved to be a genuine success, and both in numbers, in attendance and character the exposition would have done credit to a larger and more centrally located city. A high degree of interest was maintained throughout the entire week and it is the general opinion of the exhibitors that the show was well worth while.

A uniform scheme of decoration was adhered to, simple and effective. The booths were commodious and aisle space ample to allow the crowds to move freely helped very materially in contributing to the success of the enterprise. The booths were marked by both simple and decorative railings running to Corinthian columns in dead white, surmounted by ornamental caps. The electrical wiring was carried out by the General Electric Construction Company, of San Francisco. The building was illuminated with sixty 500-watt Mazda lamps, equipped with special General Electric porcelain reflectors, and suspended from the roof trusses about forty-five feet from the floor. The excellent illumination was supplemented by considerable booth lighting and by the various flame arcs on exhibition.

One of the most interesting features of the exposition was the splendid exhibit contributed by the Electrical Department of the City of San Francisco. This included a very comprehensive demonstration of police and fire telephone and telegraph apparatus, and the whole was, in fact, one of the most instructive and valuable demonstrations ever shown in any city in the country. The apparatus was made in the city shops and was installed by special permission of Mayor P. H. McCarthy, under the supervision of William H. Army, chief of the department.

The Pacific Telephone & Telegraph Company made a fine showing, its long-distance service attracting constant attention. The Western Union had an exhibit unique in its interest and in the attention it attracted, while the Southern Pacific Railroad advertised its automatic electric block system of protection and distributed some highly interesting and picturesque literature.

Among the novelties the Directograph and the telautograph divided attention with the wireless and the vacuum cow-milking machines.

A detailed list of exhibits follows:

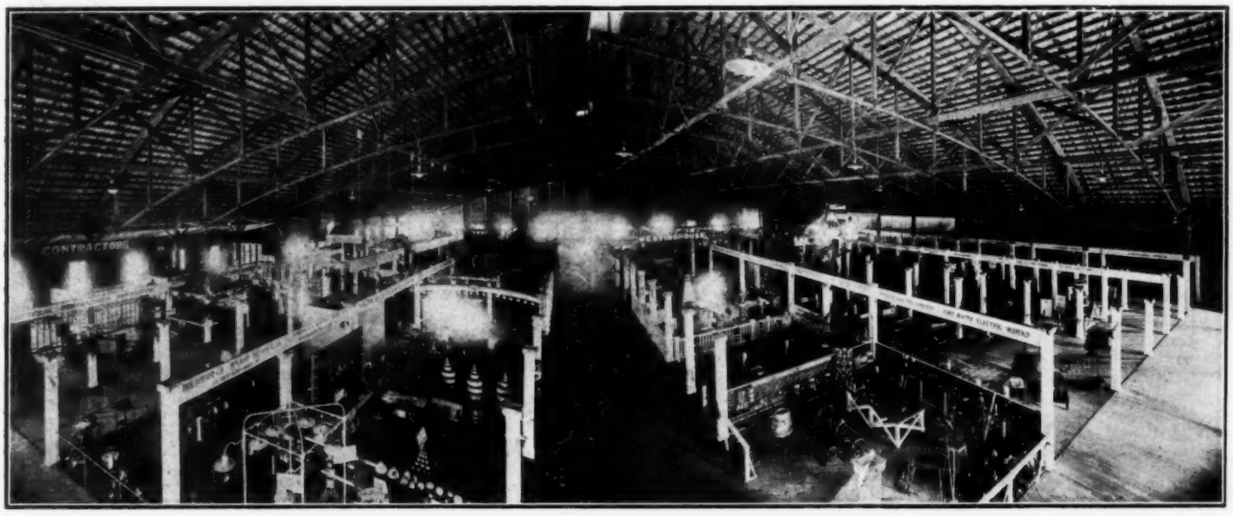
The American Electric Fuse Company, Muskegon, Mich., had on exhibition alternating and direct-current motor starters, crane controllers, battery-charging rheostats and enameled magnet wire, together with a display of telephone protector apparatus. The company was represented by P. G. Jones.

The American Ever Ready Company, San Francisco, Cal., exhibited a line of electric flash-lights, electrical novelties, vacuum bottles, miniature lamps and decorative lighting outfits, spark plugs, speedometers, automatic automobile starters and various automobile accessories. The exhibit also embodied a list of all types of dry batteries in the course of manufacture. Among those in attendance were R. F. Okes, C. E. Johnson, F. G. Beck, U. S. Johnson, A. G. Bowes, F. J. Lyons, A. D. Parker, H. D. Lapkin, C. P. Matthey, F. E. Blanchfield and G. R. Gore.

The American Ironing Machine Company, Chicago, Ill., had on exhibition a twenty-four-inch belt-driven ironer, one thirty-seven-inch and one forty-two-inch electrically heated and operated ironing machine. The latter was shown in continuous operation. The company also exhibited a number of smaller machines, and had its exhibit space transformed into a miniature laundry.

The American Steel and Wire Company displayed a complete line of bare and insulated wire, cable, wire strand and rope, rail bonds and bonding equipment. Represented by P. S. Benjamin.

The Aylesworth Agencies Company, San Francisco, Cal., exhibited a complete line of Monarch telephones, clocks, time stamps, etc., Cooper-Hewitt lamps, Schwarze bells and the "APLCO" lighting and ignition system for motor boats and automobiles. The company had an automobile wired up with lamps, storage battery and dynamo to show the actual working conditions of the apparatus displayed. W. F. Anthes, S. W. Rolph and H. G. Aylesworth were in attendance.



GENERAL VIEW OF EXHIBITS AT THE PACIFIC COAST ELECTRICAL EXPOSITION.

The Babcock Electric Carriage Company exhibited a four-passenger coupe.

James Barker, Inc., exhibited the Barker "Universal" portable vibrator and the "Universal" electric hair-drier.

The Benjamin Electric Manufacturing Company, Chicago, Ill., displayed a series of its well known lighting specialties and wireless clusters, including the new Parabolite reflector for street lamps. The company also had on exhibition a number of its new reflector sockets specially designed for tungsten lamps. F. H. Poss and Miles F. Steel were in charge.

The Brooks-Follis Electric Corporation exhibited general electrical supplies, including Fostoria Incandescent lamps, Mica Insulator Company's insulating material, Murdoch wireless outfits, Faries Manufacturing Company's brackets and fixtures, Hylo and Economical lamp, Golden vibrators, Motsinger sparkers, Sprague conduits, Crown decorative chandeliers, fans, Christmas-tree sets, electric bells, Westinghouse cooking and heating utensils, annunciators, telephones, Knobloch-Heidman magnets, Vita galvanic discharger, friction tape. C. J. Thelen.

The American Faucet Company exhibited the "Little Giant" electric vacuum cleaner, and was represented by H. G. Johnston.

The Burroughs Adding Machine Company exhibited a full line of motor-driven and hand-operated adding machines, including the new duplex features and fifteen-book variable-split machine, bank transit machine, fraction machine, the new Pike visible writer. Represented by W. W. Cooley, sales manager; J. L. Cook, H. B. McDowell, W. E. Smith, C. L. McFarland, L. V. Britt and W. A. Cooley.

The California State Association of Electrical Contractors established a comfortable reception headquarters, there being a number of special exhibits including a glass switchboard made by the Jupiter Company, moulding by the Telephone Equipment Company; conduit by the John R. Cole Company; a Westinghouse generator, Thieben lamps, Union gas engine and Pacific State Electric Company conduiets.

The Century Electric Company exhibited several of its single-phase, self-starting, alternating-current motors, and showed the assembly of its machine in detail. The California Incandescent Lamp Company, selling agents for Bryan-Marsh incandescent lamps, also occupied their booth. Represented by R. J. Davis.

The City Electric Company showed a model underground vault, with a 11,000-volt cable, pot-head, junction box, transformer. 500-volt, three-wire, five-way junction box and disconnecting switches.

The John R. Cole Company, San Francisco, Cal., had on exhibition a complete line of the specialties manufactured by the Harvey Hubbell Co., Inc., the Stanley & Patterson Company, Chase-Shawmut Company, Dessert & Company, and the Lutz Metal Molding Company.

The Columbus Buggy Company exhibited a four-passenger coupe and a runabout taken from the stock of the Bay Cities Electric Company. Represented by W. D. Vance, general manager, and E. L. Jones, manager of the San Francisco agency of the Bay Cities Company, and G. L. Taft, Pacific Coast representative of the Columbus Buggy Company.

The Crocker-Wheeler Company showed a line of two and three-phase induction motors from one-eighth horsepower up, type L direct-current motors and photograph of installation and apparatus. Represented by R. E. Martinez.

R. B. Daggett & Company exhibited Baker electric carriages and Walker electric trucks, including two four-passenger coupes, a runabout, Victoria, and a 3,000-pound truck, equipped with Exide or Edison batteries. Charging with a General Electric, three-ampere Mercury arc rectifier. This company also exhibited the Sangamon ampere-hour-meter. Represented by R. B. Daggett, Messrs. Brown, Dooling, Smith and Robbins.

The Dean Electric Company, San Francisco, Cal., had on exhibition a special private branch board designed to work in connection with either the automatic or manual telephone systems. There was also shown a magneto-harmonic board, a common-battery non-multiple board, and also a completely equipped police switchboard shown in operation. Among other features were shown bed-side telephones and a complete line of telephone and telegraph parts. The company was represented by G. A. Scoville, M. J. Corwin and F. M. Coker, Jr.

The Direct Line Telegraph Company demonstrated its interior, secret telephone service. Represented by F. A. Dunbar.

Dossert & Company, New York, N. Y., through Otis & Squires of San Francisco, exhibited sample boards and loose samples of all the products manufactured by the company.

The Drendell Switchboard & Supply Company exhibited a fine line of switchboards and panel boxes, stage plugs and fittings, resistance coils, remote control switches and automatic control apparatus. Represented by A. E. Drendiel, president, and L. Siebenhauer.

The Electric Storage Battery Company, Philadelphia, Pa., maintained an exhibit in charge of Pierson, Roeding & Company, of San Francisco. The main feature of the exhibit was the low-voltage tungsten lighting outfits of the company for use in farmhouses and country residences. These outfits consisted of a gasoline engine driving a small generator, a storage battery of sixteen cells with three counter-cells for regulation, and a complete switchboard. This outfit was shown in actual operation. The current generated was used to light about fifty, eight and sixteen-candlepower tungsten lamps which were placed about the booth. In addition there was shown a full set of vehicle-battery trays, showing the Exide battery as furnished for the various vehicle manufacturers. The Exide spark battery for gasoline-engine ignition was also shown complete and in section. In addition to the Exide battery there was also exhibited a full line of Chloride Accumulator cells of various sizes, also individual plates and parts. The exhibit was in charge of W. G. Bardens and B. B. Beckett of the Electric Storage Battery Company. J. P. Bradner, C. G. Gauntlett and C. L. Turner were also in attendance.

The Electric Railway and Manufacturers' Supply Company showed a handsome line of switchboards, panel boards, panel boxes and fittings manufactured by the Trumbull Electric Manufacturing Company. This company also exhibited a complete line of De Vean telephone apparatus and Duncan meters.

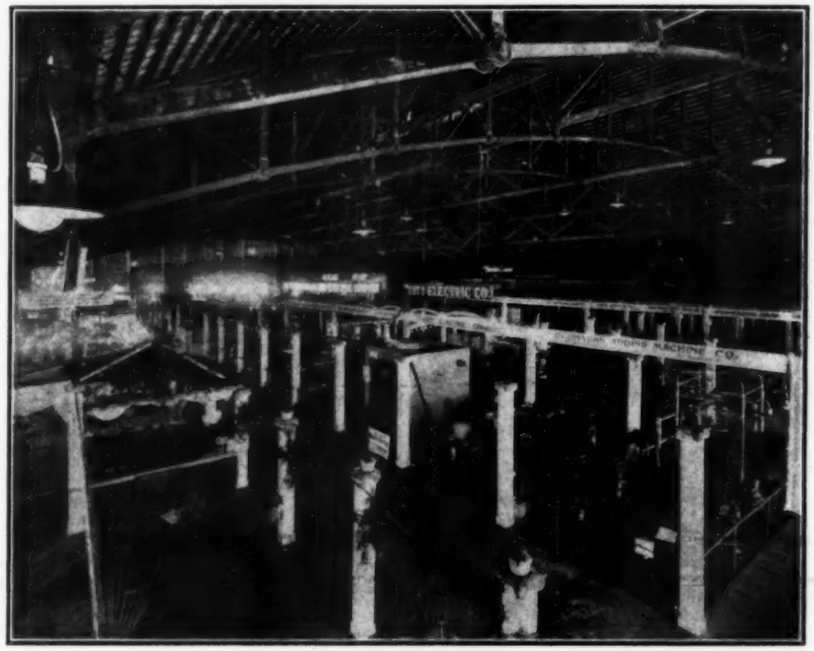
The Engineering Maintenance Company, San Francisco, Cal., had on exhibition a full line of Crocker-Wheeler motors, including the form L and small induction motors. The feature of this exhibit was a model printing-office operated throughout by means of Crocker-Wheeler motors, in which was published a daily paper that was distributed to the visitors. The exhibit also included displays of Alba and Aurola flaming arc lamps, Siemen's carbons for enclosed arc lamps, Siemen's Bio carbons for moving picture machines, and other lines of the Chas. L. Kiewert Company of New York.

The Fred Fisher Company exhibited the Directograph, a unique writing device demonstrating the method of controlling, through a telegraph circuit, the vertical and horizontal travel of a motor with a single push button.

The Fort Wayne Electric Works exhibited an electric rock drill equivalent to one-and-three-quarter-inch air drill, doing the work of a drill of this type with one-tenth the energy. The principle of operation depends upon rotating hammers. It is driven by a one-and-three-quarter-horsepower motor, either direct or alternating current. This is furnished with a tripod and column or quarry bar as required. The drill was worked on a block of sandstone furnished by the Colusa Sandstone Company. A steam generating set, five kilowatts in capacity, the engine manufactured by the United States Rapid Fire Gun & Power Company, connected with a five-kilowatt Fort Wayne generator was also shown, also a line of direct and alternating-current generators and motors for both large power purposes and small motor application, moving picture compensating transformers (the "compensarc") for the alternating and direct current circuits, a full line of watt-hour meters for both single-phase and polyphase circuits, a complete line of supplies, including fan motors, bell-ringing transformers, power transformers, tungsten low-voltage transformers and arc lamps, "Paul" type high-speed power pump and air-compressors, and variable speed controllers for alternating and direct-current circuits. A General Electric mercury-arc rectifier furnishes current for the rock drills. Represented by G. I. Kinney, district manager, J. E. Rodd, J. W. White, F. O. Sievers. A. L. Searles sales manager of the rock-drill department, and R. C. Dugdale, mining engineer, in charge of rock drill exhibit.

The General Accustic Company, New York, N. Y., exhibited in the booth of the National Dictograph Company its instruments for facilitating hearing. Richard A. Fanton was in charge.

The General Electric Company made an elaborate display of heating and cooking devices, showing a new electric range with



EXHIBITS AT THE PACIFIC COAST ELECTRICAL EXPOSITION.

oven, hot disks and several innovations. A feature of this display was the "white outfit," demonstrating the cleanliness and sanitary value of electrical cooking operation. The new "intensified" arc, giving a "daylight illumination in a number of handsome patterns, attracted a great deal of attention. There was also a full line of Mazda incandescent lamps, as well as a full line of Gem, tantalum and carbon lamps. Motors, generators, controllers, automatic switches, and remote control apparatus, for both alternating and direct-current circuits, were also shown. The company was represented by A. M. Hyler and C. M. Bliven.

The Gray National Telautograph Company, New York, N. Y., had on exhibition seven complete telautograph sets, several of these being shown in operation. The company was represented by W. G. Vincent, Jr., and William Joice.

The H. W. Johns-Manville Company, New York, N. Y., exhibited a complete line of the products of the company, including Noark service and subway boxes, Noark enclosed fuse material, dry batteries, fibre conduit and fittings, asbestos roofing, insulating materials, packings, and the Linolite system of electric lighting, Linolite desk and table lamps, and a number of special silver-plated reflectors for picture lighting were also shown. Overhead materials were shown in quite a variety of products, among which may be mentioned the Giant strain insulator. J. M. fibre conduit, together with a complete line of fittings, tees, elbows and crosses, etc., formed a feature of the company's exhibit. The exhibit was in charge of W. S. Greenfield, assisted by S. P. Russell, J. H. Daveler, W. R. Jones, F. S. Mills and C. G. Gunderson

EXHIBIT OF NATIONAL ELECTRIC LAMP ASSOCIATION.

The Holabird-Reynolds Company displayed a complete line of Pacific Electric Heating Company's "Hot-Point" irons, Ohio Brass Company's O. B. high-tension insulators, Paiste pipe taplets, Franklin Mazda lamps. A feature of the exhibit was the beautiful Franklin kite sign. There was also displayed National Carbon Company's Columbia dry batteries and Proctor-Raymond bells. Represented by Ross Holabird and O. K. Jones.

The Home Telephone Company, San Francisco, Cal., exhibited an automatic telephone exchange in full operation. The Company's headquarters occupied 1,000 square feet, and the display exemplified the equipment used in an actual city telephone system of the automatic type. Special services, such as those for private exchanges of various types, were also shown in working form. Direct wire service was also maintained from the exchange headquarters to all parts of the territory served by the company. N. J. Prendergast, Gerald Deakin, F. L. Bahr and H. T. Bailey were in attendance.

The Ideal Electric Company exhibited the Ideal electric brougham, the largest four-passenger electric automobile made, equipped with Westinghouse hill-climbing motor, and equipped with the Motz cushion tire, eliminating punctures and tire trouble. Represented by F. L. Gerke.

The Keller Manufacturing Company, Philadelphia, Pa., was represented by the Laugenour Sales Company of San Francisco, who exhibited a complete line of Keller vacuum cleaners, including the portable and stationary types. The exhibit also included a glass display machine which showed the motor, pump and other parts of the Santo cleaner in operation, also an electrically lighted Keller-Santo machine with windows showing the complete working parts of this particular type of cleaner.

The Kellogg Switchboard & Supply Company, Chicago, Ill., exhibited magneto and common-battery telephones, a harmonic switchboard, private branch exchange switchboards, railway dispatching equipment, special telephones for power companies, and a full line of miscellaneous apparatus. H. C. Goldbrick, L. H. Baldwin and C. F. Hartung were in attendance.

The Chas. L. Kiewert Company showed a complete line of six different types of flaming arc lamps, including Alba, Aurola, Trucolor, Economy, Lilliput and Alba Triplex, all of Siemens make. There was a show window demonstration, the white lights of the Trucolor lamps, and a moving picture machine demonstrating the Siemens moving picture Bio carbons, Siemens' E carbon for standard enclosed arcs, and a full line of Siemens flame carbons. Represented by R. E. Martinez and R. F. McDonald, manager of Chas. L. Kiewert Company of San Francisco.

Kohler & Chase exhibited an extensive line of automatic piano players and musical instruments.

The H. Krantz Manufacturing Company, Brooklyn, N. Y., exhibited through Otis & Squires of San Francisco, a complete line of switches, panel boards, outlet boxes and miscellaneous material.

The Levy Electric Company, San Francisco, Cal., maintained a booth wherein was shown by means of moving pictures the facilities of the company for the prompt execution of repair work. The company also conducted an illustrated demonstration of the Arnold vibrator and the 1900 washing machine, and also a full line of household utensils, etc. The company was represented by Victor A. Kuehn, John J. Hyer, Chas. S. Fries, Harry D. Havey, Arthur Meyers, Harold Wolfe, Wm. Schafer, and Victor Marks.

The National Dictograph Company of New York, N. Y., exhibited the dictograph master station connected with several substations scattered through the building. The master station was placed in the booth and represented the private office of the head of a concern. The public was allowed to enter this booth and converse with the various substations standing several feet away from the master station. The exhibit was in charge of Richard A. Fanto and S. M. Nye.

The National Electric Lamp Association, Cleveland, Ohio, occupied four booths in the center of the building. Decorative arches were constructed around the booth, and from these arches were suspended the various sizes of Mazda lamps and Holophane reflectors. A complete line of 110 and 220-volt Mazda lamps, 110 and 220-volt tantalum lamps, tantalum street-railway lamps, Mazda street-series, sign, miniature, and low-voltage lamps were also shown. Some of these were shown burning on racks, and the remainder were exhibited in glass show-cases. There was also shown a device which permits a light distribution about a lamp to be readily attained. A Bunsen photometer which showed the increased amount of light coming from a 100-watt Mazda lamp as compared with the 100-watt carbon lamp was also on exhibition. A set of automobile head-lights, side-lights, etc., were also shown. A comparative test on carbon and the new double-wound tantalum railway lamps was conducted during the course of the show, the object being to show the difference in current consumption in the two lamps. Among those in attendance were J. A. Vandegrift, L. S. Twomey and A. J. Hitzker.

The National India Rubber Company, San Francisco, Cal., exhibited its various wires and cables on reels, lamp cords, and telephone and smaller wires on a sample board. In addition they displayed numerous sample boards containing the various lines as manfactured by the company. H. V. Gladstone was in charge of the exhibit.

Otis & Squires made an attractive exhibit of various specialties, including the apparatus manufactured by the Cutler-Hammer Manufacturing Company, H. Krantz Manufacturing Company, Mathias Klein & Sons, American Conduit Manufacturing Company, Machado & Roller, Knobloch, Heideman Manufacturing Company, L. B. Allen Company, Dossert & Company, Van Nest Carbon Brush Company, Paragon Sellers Company and Columbia Incandescent Lamp Company. Represented by H. B. Squires.

The Pacific Electric and Manufacturing Company exhibited an 80,000-volt, 200-ampere, solenoid-operated oil switch, the Wood motor-starter and protecting switch and a pole-top power-line switch for high-tension circuits, a few examples of the company's

disconnecting switches. Represented by Joseph S. Thompson, manager.

The Paraffine Paint Company, Emeryville, Cal., had on exhibition a line of insulating pitch, tape, paints and floor covering for power-houses and substations, etc., together with an exhibit of Malthoid roofing.

Parrott & Company showed a line of Kimble single-phase and three-phase motors, including reversible and printing-press and blower motors. A Chandler & Price job press was driven by a Kimble one-half-horsepower, 110-volt, sixty-cycle, single-phase motor. This company also exhibited the Grant flaming arc lamp, the Sun-Ray, alternating and direct-current arc lamp, and the Parrott tungsten lamp in all sizes and types, from twenty-five candlepower up. Represented by C. C. Manker, C. R. Frank and A. G. Hanton.

Pierson, Roeding & Company exhibited a complete line of Electric Storage Battery Company's products. A feature of their exhibit was an equipment for small country houses, including battery, generator, gas engine and switchboard. This company also represented the J. G. Brill Company, Locke Insulator Manufacturing Company, Aluminum Company of America, Lombard Governer Company, Ohio Brass Company, Fibre Conduit Company, R. D. Nuttall Company, and General Incandescent Lamp Company.

Rauch & Lang exhibited a large four-passenger extension coupé, equipped with Exide or Edison batteries. Represented by G. A. McDougald.

The Red Cross Antiseptic Glass Mouthpiece Company of San Francisco, exhibited their new glass telephone mouthpieces. Represented by W. M. English.

The Reliance Automobile Company exhibited four-passenger brougham and three-passenger coupé, equipped with Exide and Edison batteries. Represented by S. M. Crim and C. S. Richardson.

The San Francisco Compressed Air Cleaning Company, San Francisco, Cal., exhibited a complete line of Duntley electric vacuum cleaners, Duntley electric air washers, and miscellaneous apparatus manufactured by the Duntley Manufacturing Company, of Chicago. The exhibit was in charge of H. C. Hand, W. W. Beachboard and H. O. Davis.

The San Francisco Gas & Electric Company, San Francisco, Cal., while not exhibiting, maintained a booth where visitors to the show were cordially received. The company had a number of guides present who conducted visitors around the building, explaining various features of the show.

The Southern Pacific Company, San Francico, Cal., displayed a miniature block signal system in operation in addition to haveing a full size block signal in working order. The company had in its booth an electrical stereopticon machine for displaying views of California, as well as drawings and plates of a number of its electric power plants now under construction. Attractive travel literature was also distributed.

The Sprague Electric Company made a display of conduit supplies, including armored conductor and fittings. Represented by G. I. Kinney, district manager, and J. A. Herr, who was in charge of the exhibit.

The Standard Underground Cable Company, Pittsburg, Pa., exhibited coils of wire, of bare and insulated copper wire, lead covered cable, bare and insulated copper-clad wire, Davis open air and Davis station terminals, insulating compound, insulating tape, manhole cable supports and other cable accessories. The company was represented by A. B. Saurman, E. K. Preston, W. G. Stearns and L. A. Knott.

Studebaker Bros. Company, San Francisco, Cal., exhibited several types of Studebaker electric pleasure vehicles, including a Victoria phaeton, a coupe, and landaulet.

The company also exhibited a Westinghouse rectifier, giving details of the idea of home electric charging outfits. The exhibit was in charge of John H. Eagel.

The Telephone Electric Equipment Company, San Francisco, Cal., exhibited switchboards, telephones and telephone material of the Stromberg-Carlson types, electric heating goods and cooking devices manufactured by the Simplex Electric Heating Company of Cambridge, Mass., and apartment house telephones, annunciators, motors and electrical specialties manufactured by the Holtzer-Cabot Electric Company of Boston, Mass. Those in attendance included A. E. Rowe, H. E. Bittmann and S. L. Hawkin.

Jos. Thieben & Company displayed Eastern and Star incandescent lamps, Howard miniature lamps, Novelty Electric Sign Company's signs showing the consumption of Mazda and carbon lamps, Reynolds flashers, Multiple Christmas sets, Glieson-Tiebout & Company fixtures and glasswares, and Stave flaming arcs. Represented by A. R. Wertheimer.

J. S. Trezise exhibited the Cutler electric water heater.

The United Manufacturers exhibited a line of ignition specialties made by the Connecticut Telephone and Electric Company, including magnets, master vibrators, distributors, Jones electric horns, Jones live-map meters. Represented by H. W. Coffers.

The Vacuum Specialty Manufacturing Company exhibited the Monarch renovator. This is a portable cleaner, weighing twenty-eight pounds and the suction is obtained by means of a turbine element in the base of the container.

The Walters Surgical Company made a fine showing of medical and surgical electrotherapeutic apparatus.

The Westinghouse Electric & Manufacturing Company, Pittsburg, Pa., exhibited a full line of motor-driven appliances, consisting of vacuum cleaners, ice-cream freezers, buffers, grinders, sewing-machines, washing-machines, meat choppers, small refrigerating plants, blacksmith blowers and ventilating and suction fans. The operation of pumping, pulling and drilling in oil wells was illustrated by a miniature oil-well derrick, driven by a specially designed motor. The Detail and Supply Department exhibited a line of transformers, oil circuit-breakers, switches and kindred apparatus. There was installed in the booth a complete switchboard shown in operation, on which was mounted a number of the various types of switchboard instruments manufactured by the company. There were also shown a line of heating and cooking appliances, these being shown in operation by competent demonstrators. The company's booth was tastefully decorated and a comfortable reception room was provided wherein visitors were cordially received and served with food prepared in the electric utensils. The exhibit was in charge of W. W. Briggs and T. E. Collins. J. G. DeRemer, C. E. Heise, L. A. Somers, H. H. Daley, M. K. Cooper, W. R. Dunbar, C. D. Herbert, J. E. Bridges, J. J. Pottinger, R. A. Balzari, and H. S. De Lancie were also in attendance.

The Weston Electrical Instrument Company exhibited for the first time the new Weston switchboard wattmeters, both single and polyphase, synchroscope, power factor meter and frequency meter, all of which are in operation in the main leads supplying the exposition with light and power. Besides these a full line of regular switchboard and portable instruments are shown. The company was represented by Frank E. Smith.

The Bramfield Electric Sign Company made a fine display of electric signs, showing several forms of letters in relief and shadow effects as well as flashing and color-changing innovations.

The Holophane Company, Newark, O., made no regular exhibit, but was represented by F. H. Poss and Miles Steel.

CENTRAL ELECTRIC RAILWAY ASSOCIATION.

THE FALL MEETING OF THE ASSOCIATION HELD AT THE CLAYPOOL HOTEL, INDIANAPOLIS, SEPTEMBER 22.

The first regular meeting since the summer vacation, of the Central Electric Railway Association was called to order on September 22, at the Claypool Hotel, Indianapolis. In calling the convention to order president George Whysall said the large attendance was a matter of congratulation to the association, but in view of the wreck on the Ft. Wayne and Wabash Valley Traction line a gloom is cast over the meeting which is hard to dispel. At the suggestion of the president the secretary, A. L. Neereamer, was directed to send a telegram to C. D. Emmons, general manager of the unfortunate road, expressing the sympathy of the members of the Association in general.

The minutes of the previous meeting held in Toledo, O., were approved as read.

Under the head of reports of committees, the Committee on Insurance was granted further time. The committee appointed to compile and publish an up-to-date map of the interurban lines in the Central States reported progress, and on a vote by roads the committee was directed to proceed with the publication of such a map. The Committee on Revision of the By-Laws and Constitution made a report setting out the revision advisable in certain articles and clearly stating the object of the Association to be the "promotion of knowledge on all matters relating to the construction and management of electric railways; to consider and discuss questions of interest and disseminate information; to promote the interchange of traffic, to encourage social relations among its members, and in all other proper ways advance electric-railway interests." The revision was approved. The first number on the program was a talk on "Large Station Units," by George J. Smith, Chicago, Ill. Mr. Smith thanked the Association for the invitation to present his paper and in his talk showed, by the use of stereopticon slides, the Fifty-ninth and Seventy-fourth street stations in New York. The manner and equipment for handling coal, the

pumping of water, the amounts of each required were touched upon, the capacity of boilers, engines, turbines, condensers, weight and size were all given and the operation of the station fully explained. Mr. Smith stated that it required forty-seven men working continuously to keep the big plant oiled—a greater number than is employed on the engineer's force. "Design and Efficiency of High Tension Insulators," was the subject of a paper presented by A. O. Austin, of Mansfield, Ohio. In his paper, which was well illustrated with stereopticon views, he pointed out the work that had been done toward improving insulators. He said that the insulator should be designed not so much for high tests in the laboratory as for efficiency after it has assumed a working condition on the line. In describing the various types of insulators and their resistance Mr. Austin said when the importance of the insulator to any transmission system is considered, it is surprising that so little systematic research work has been done. He thought this was due to the fact that the manufacturer depends on secret processes. However, early as well as more recent tests developed the disk suspension insulator, which has been adopted on practically all transmission lines installed in the last two years. Mr. Austin analyzed the behavior of the several types of insulators as they were illustrated and brought out many new ideas relative to resistance and leakage. He said when lines are equipped with insulators of good design and great dielectric strength, much of the trouble will be eliminated. In addition Mr. Austin concluded by saying: "the subject is the most interesting in the transmission field today and is so exhaustive it has been impossible to treat even the few characteristics discussed with the fullness that they deserve."

It being past the noon hour there was no discussion of Mr. Austin's paper.

The afternoon session was commenced by the reading of a paper on "Track Work" by E. B. Entwisle, chief engineer, Lorain Steel Company, Johnstown, Pa.

Mr. Entwisle gave a brief history of the origin of tramways and rails, beginning with the oldest types in existence 275 years ago. The development of the different kinds of rails and method of track construction leading up to standardization of American street and interurban lines proved an interesting subject.

The concluding paper was read by W. E. Davis, vice-president of the Cleveland Construction Company. Mr. Davis spoke of the remarkable development and improvements that had been made in the methods of producing and distributing electrical energy, remarking that fears are now entertained lest a power plant under construction will be out of date by the time of its completion. A very interesting feature of Mr. Davis' paper was the description of the modern electric locomotive. Mr. Davis' paper was briefly discussed by C. L. Henry, who related some experiences on the single-phase line operated by him.

The report of the Standardization Committee, providing that cars in use by the roads now members of the Association be changed to the standard and likewise all new cars made so that the couplers will conform, was adopted.

The next meeting of the Association will be held in Dayton, Ohio. This will be the annual meeting at which time officers will be elected.

National Association of Cotton Manufacturers.

At the eighty-ninth semi-annual meeting of the American Association of Cotton Manufacturers, held at Portsmouth, N. H. September 15 to 17, the majority of the papers read dealt with subjects of interest only to the textile industry. Among the papers, there were, however, two which dealt with subjects of interest to the man in the power house and the shop. These were "Economical Lubrication," by W. M. Davis and "Natural and Artificial Draft," by H. G. Brinckerhoff. Abstracts of these follow.

ECONOMICAL LUBRICATION.

Lubricants are of three kinds, fluids, (oils), plastic (greases), solids (talc or soapstone, graphite, etc.). Oils are most satisfactory for combined high speeds and great pressures; greases are suitable for low or medium speeds and light pressures; solid lubricants are used in special cases. Three economical points are to be considered in all cases: (1) Selection of lubricants to give good service as regards cool bearings, low friction, loss, etc.; (2) buying same at lowest market price; (3) using them economically. For light-running high-speed machinery, use light-bodied or fluid oils; for slow-speed machinery, use heavy-bodied oils. For high-speed work and engines where continuous oiling systems are in use, a light-bodied oil should be used. A close indication of the relative values of different oils can be obtained by the usual physical tests for gravity, flash test, cold test, viscosity, and, in the case of cylinder oils, a chemical analysis for percentage of fatty oil. Service tests may further be made. On these latter the use of the thermometer is of value. Reliable appliances for feeding oil will save money. In many cases a cheap oil is quite as suitable as an expensive oil, sometimes more so, and comparative tests along this line will often result in decided economies. In using continuous oiling systems there is no decided economy to be gained unless precautions be taken to recover the oil used. In well installed apparatus of this kind very little oil is required to make up for losses. The installation of an oil and waste-saving machine will often result in marked saving of oil. Receiving, storing and distributing lubricants are often important factors. In large plants it is an economy to proivde storage capacity so that the oils can be bought in tank car lots. Reduction in price and cost of handling will result from this policy. In small plants oils should be kept in tanks filled by gravity from the oil barrels, the latter being carefully kept, and sold when empty. The keeping of records is also an important factor. An efficient record and cost system will result in increased economy. Finally, all hands should be carefully trained in the careful use of lubricants.

NATURAL AND ARTIFICIAL DRAFT.

The first part of this paper is taken up with a discussion of chimney design. It is shown that the height of a chimney is the only consideration affecting the pressure of the draft (making due allowance for skin friction of the shaft itself, the boiler tubes, breeching, etc., and the resistance afforded by the fire and the bends in the air passages), while the amount of the draft is governed by the cross-sectional area of the air passages. A high chimney is expensive but the cost is more or less offset by the use of fewer boilers and the decreased expenditures consequent on this economy. The following items enter in the design of a new chimney: (1) Local conditions, especially atmospheric; (2) relative location of chimney and boilers; (3) type of boilers and grates; (4) quality and depth of coal. The author states that on the basis of a temperature of 450 degrees Fahrenheit in the flue gases and an outside air temperature of sixty degrees, a stack 100 feet high will give a draft pressure of 0.6 of an inch of water, this, of course, being independent of the cross-sectional area of the chimney. He quotes T. F. J. Maguire for loss of draft in boiler setting as 0.3 of an inch of water for water-tube boilers, increasing this to 0.4 of an inch for an overload of fifty per cent. The author considers the same allowance to hold in the case of horizontal return-tubular boilers, and half of this, or 0.15 of an inch, in Manning and vertical types of boilers. Maguire allows 0.1 inch per 100 feet of length to circular iron flues, and 0.5 inch for each right-angle turn. The square or rectangular shapes, increase this by twenty-five per cent. For brick flues, increase it thirty per cent. The author allows for the stack travel the same as for breeching. In a worked example, in the case of a horizontal return-tubular boiler, the figures are:

Furnace draft for 25 pounds soft coal.	0.2
Horizontal return-tubular boiler.....	0.3
50 feet of steel breeching.....	0.05
Rectangular shape, 25 per cent more.	0.0125
Two right angles	0.1
Round brick chimney 150 feet.....	0.15
Brick surface, 30 per cent more.....	0.045
Total draft required.....	0.8575

This is approixmately 0.9 inch, which, on the assumption of 0.6 inch of water for 100

feet of stack, gives a chimney 150 feet high. Artificial drafts are briefly considered under the heads Induced Draft, Forced Draft, Balanced Draft. It is pointed out that by using powerful fans the outlay for boiler installations can be reduced from twenty-five to fifty per cent. A detailed calculation for a chimney 100 feet high concludes the paper.

A paper on illumination, also read at this meeting, is abstracted on other pages of this issue, beginning at p. 685.

Convention of the Association of Railway Electrical Engineers.

The third annual convention of the Association of Railway Electrical Engineers was opened at the Hotel La Salle, Chicago, Tuesday morning, September 27. As intended by the various committees in charge of affairs the attendance included representation from practically every large steam road in the country and while the early registration was not very large, at the close of the first session indications pointed to this convention being the most successful in the history of the Association.

The meetings were held in the spacious banquet hall on the nineteenth floor of the hotel. The exhibits, which occupied about two-thirds of the space, were laid out on the booth plan, as is customary in electric shows in the larger cities. Artistic columns were placed at each corner of the booths and these were connected and entwined with floral decorations which harmonized in every respect with the interior decorative scheme, making the spectacle on the whole a most pleasing one.

The exhibits were of a comprehensive nature, practically every appliance used by the electrical department of a steam road being shown. Prominent among the exhibits were displays of the newer types of tungsten filament lamps and the new Edison storage battery. The exhibits will be described in our next issue.

The first session was called to order by President E. M. Cutting, who, after making a few brief announcements, delivered the annual presidential address.

Mr. Cutting briefly reviewed the work accomplished by the Association, and lamented the fact that his residence on the Pacific Coast prohibited his taking an active part in the Association's affairs during the past year. He spoke of the talk among several of the members regarding holding the future conventions at Atlantic City, and cautioned the Association to consider all sides of the question before making the decision.

The question of affiliating with the Master Car Builders' Association was also taken up, and President Cutting strongly advocated that no action be taken in this direction, He commended the Railway Electric Supply Manufacturers' Association for its efforts in producing such an elaborate display.

Following this address the report of the secretary-treasurer was read and adopted. In this report the membership of the Association was given as 486.

The report of the Committee on Illumination was next read by J. R. Sloan, in the absence of H. C. Meloy, chairman of the committee. This report dealt particularly with the improvements which have been made from time to time in the different types of incandescent lamps, particularly as regards tungsten. The committee reported that the remarkable progress made by the lamp companies in the development of tungsten-filament lamps, especially train-lighting types, is shown from the fact that one year ago only one road had standardized the tungsten lamp to the exclusion of all other types, while today practically all the railroads are using this type of lamp with entire satisfaction. The report further comprised a number of curves showing the candlepower and light performance of the lamps of different sizes, the results being obtained from lamps furnished by the leading lamp companies and tested by the consumers in their own laboratories. The committee recommended that the two standard ranges of voltage for car-lighting lamps be continued, namely, twenty-eight to thirty-four volts, inclusive, and fifty-seven to sixty-five volts, inclusive. It was further recommended that the use of lamps other than the round bulb lamp be abandoned as soon as possible.

Following the reading of this report Henry Schroeder called the attention of the Association to the exhibit of pressed-filament lamps for train-lighting service which was being shown by the General Electric Company.

The question of tungsten lamps being stolen from trains was taken up by A. J. Farrelly, who asked for information regarding the various locking devices on the market, and also methods of etching incandescent bulbs.

Messrs. Woodhead and Schroeder, of the Central Electric and General Electric Companies respectively, replied to Mr. Farrelly, mentioning the types of locking devices on the market and explained the methods commonly used for etching.

A. J. Farrelly asked for the experiences of any of the members regarding the use of tungsten lamps for station lighting with a view to obtaining information regarding the lighting of the new North Western station in Chicago. A. J. Collette, of the Union Pacific Railroad, answering Mr. Farrelly, said that all of the newer stations of the Union Pacific were being equipped throughout with tungsten lamps, generally of the sixty-watt size, with excellent results.

At the afternoon session the report of the Committee on Data and Information was presented.

In the evening there was an informal reception and dance.

A report of the remaining sessions will be given in our next issue.

Interurban Wrecks in Indiana.

Four interurban railroad wrecks occurring within a week's time, and causing the death of fifty passengers and trainmen, is the record for Indiana for the week ending September 24.

The first wreck occurred near Union City, September 19, on the Indiana Union Traction line and one passenger was killed. The second was on the Ft. Wayne & Wabash Valley traction line at Kingsland north of Bluffton. In this forty-two persons were killed and twenty injured. The third wreck occurred near Tipton on the Indiana Union traction line. Five passengers and one motorman were killed and twelve persons were injured. The fourth occurred at Thirty-fourth Street, Indianapolis, September 24, injuring three passengers and one motorman.

The Railroad Commissioners assert that they believe practically the whole trouble is in the organization and operation of the traction systems.

Judge Woods, chairman of the Commission said he felt assured these accidents which have recently occurred would have been averted had the electric lines observed the instructions of the Commission, following the investigation of the wreck on the Chicago, Lake Shore & South Bend traction line in June last year. S.

HOW TO DESIGN A CONSTANT-POTENTIAL DIRECT-CURRENT DYNAMO.—III.

BY W. T. RYAN.

(O) Yoke.—The cross-section of the yoke for a multipolar machine will be:

$$A_y = \frac{\phi'}{2\,B_y} \qquad (58)$$

where ϕ' = flux per pole.

B_y = magnetic density in the yoke.

If the yoke and pole core are made of the same material the magnetic density employed in the yoke is usually only eighty per cent to ninety per cent of what it is in the pole core. For a cast-steel yoke use 65,000 to 75,000 maxwells per square inch; for a cast-iron yoke use 40,000 to 45,000.

(P) Air Gap.—According to Press

$$Air\ Gap\ (maximum) = \frac{D}{20+D} \qquad (59)$$

$$Air\ Gap\ (minimum) = \frac{D}{80+D} \qquad (60)$$

where D = diameter of armature in inches.

For ordinary purposes an average of the above values will be about right.

(Q) Ampere-Turns.—Lay off the magnetic circuit to scale on a drawing board and prepare a table as follows:

PART	MAGNETIC DENSITY	LENGTH OF MEAN LINE	AMPERE-TURNS	TOTAL AMPERE-TURNS
Yoke				
Pole Core				
Air Gap				
Teeth				
Armature Core				
Total.				

As the quantities indicated are obtained, insert them in the above table. Changes made necessary by other adjustments in the design can quickly and very easily be made by referring back to this table.

The ampere-turns may be obtained either from tables or by the following formula:

$$NI_m = \frac{0.315\,B\,L_m}{y} \qquad (61)$$

where NI_m = ampere-turns necessary to force the flux through the part of the circuit under consideration.

L_m = mean length in inches of the part of the circuit under consideration.

B_m = corresponding flux density in maxwells per square inch.

y = permeability of the magnetic material. (See Table XVI.)

TABLE XVI.

PERMEABILITY OF DIFFERENT KINDS OF IRON AT VARIOUS MAGNETIZATIONS.

Flux Density in Maxwells per square inch.	Annealed Wrought Iron.	Commercial Wrought Iron.	Gray Cast Iron.	Cast Steel.	Sheet Steel.
20,000	2,600	1,800	850	2,500	2,400
25,000	2,900	2,000	800	2,600	2,500
30,000	3,000	2,100	600	2,750	2,625
35,000	2,950	2,150	400	2,700	2,750
40,000	2,900	2,130	250	2,650	2,860
45,000	2,800	2,100	140	2,600	2,975
50,000	2,650	2,050	110	2,475	3,100
55,000	2,500	1,880	90	2,300	3,000
60,000	2,300	1,850	70	2,100	2,900
65,000	2,100	1,700	50	1,800	2,775
70,000	1,800	1,550	35	1,475	2,660
75,000	1,500	1,400	25	1,160	2,500
80,000	1,200	1,250	20	1,000	2,400
85,000	1,000	1,100	15	850	1,900
90,000	800	900	12	750	1,400
95,000	530	680	10	690	1,100
100,000	360	500	9	590	900
105,000	260	350	...	525	480
110,000	180	260	...	475	310
115,000	120	190	...	425	178
120,000	80	150	...	390	145
125,000	50	120	...	350	99
130,000	30	100	...	250	69
135,000	20	85	...	150	40
140,000	15	75	...	100	20

By means of equation (61) find the number of ampere-turns required: (1) to force the no-load flux through the yoke; (2) through the pole core; (3) through the air gap; (4) through the teeth; (5) through the armature core. Add these five values together, thus obtaining the no-load ampere-turns, which is also the number of ampere-turns on each shunt-field coil.

Allow a reasonable thickness for the field spool (say three-eighths of an inch), and determine the length of an inside field turn. Allow a reasonable depth of winding (which will be corrected later) and calculate the length of a mean turn.

Assume that a definite amount, say twenty per cent of the total electromotive force, is taken up by the shunt-field rheostat, the voltage on one shunt-field coil will then be:

$$E_f = \frac{0.8\,E}{p} \qquad (62)$$

where E = voltage of machine.

p = number of poles.

The resistance (hot) of the shunt field will be:

$$R_f = \frac{E_f}{I_f} \qquad (63)$$

where I_f = shunt-field current as taken from Table IX.

The size of the shunt-field wire will then be, in circular mils:

$$a = \frac{12.02\,L_f}{R_f} \qquad (64)$$

where L_f = length of shunt-field wire in feet.

12.02 = hot resistance of a mil-foot of copper.

Dividing the no-load ampere-turns as obtained above by the shunt-field current gives the number of turns on each shunt-field coil. Multiplying this by the mean length of one turn, in feet, as obtained above, gives L_f the total length of copper wire in feet in each coil.

Choose a size of wire from a wire table which is as near the calculated size as possible. Use not less than a double-cotton covering for the minor insulation. Make a proper allowance for major insulation, for a field spool, etc., and see if the winding will fit in the space available for it. Check the temperature rise by equation (56). The number of circular mils per ampere in the shunt-field winding usually falls between 800 and 1,200. If the shunt-field coil is not well proportioned it will be necessary to go back and make such changes as are required to improve its proportions.

(R) Series Field Coils.—The armature demagnetizing turns per pole will be:

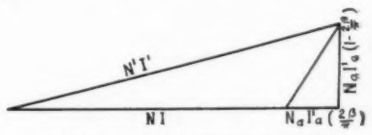


DIAGRAM OF AMPERE-TURNS.

$$N_d = \frac{2\beta}{\pi} N_a\,I'_a \qquad (65)$$

where N_d = demagnetizing turns.

N_a = number of armature turns per pole.

I'_a = armature current per path.

β = angle of brush lead in radians.

In ordinary machines one-fourth the angular distance between pole tips would be a fair value for β.

The armature cross-magnetizing turns per pole will then be:

$$N_a\,I'_a\left(1-\frac{2\beta}{\pi}\right)$$

In order to get the total number of ampere-turns necessary to give the same induced electromotive force at full load as at no load, add the demagnetizing

ampere-turns directly to the no-load ampere-turns, and add the cross-magnetizing turns at right angles.

$$N'I' = \sqrt{\left[NI + N_a I'_a \frac{2\beta}{\pi}\right]^2 + \left[N_a I'_a \left(1 - \frac{2\beta}{\pi}\right)\right]^2} \quad (66)$$

where $N'I'$ = total number of ampere-turns necessary to maintain the same induced voltage in the armature at full load as at no load.

NI = no-load ampere-turns = shunt-field ampere-turns as calculated above.

$$N_s I_s = N'I' - NI \quad (67)$$

approximately, where

$N_s I_s$ = number of ampere-turns necessary to provide on the series-field coil in order to maintain the same induced voltage at full load as at no load.

If the machine is to be compounded not more than ten per cent, it will be sufficiently accurate for practical purposes to take the percentage compounding of $N'I'$ as the number of ampere-turns additional to the above (equation 67) to be furnished by the series field. This is on the assumption that the increase in the shunt-field ampere-turns due to the increased electromotive force applied to the shunt-field terminals as the voltage increases just about offsets the increase in the number of ampere-turns required on account of the lower permeability, due to the increased magnetic density. This approximation will be found to hold quite closely in commercial machines. Provide twenty-five per cent, at least, more series turns than the calculated number. When the machine is tested a "jumper" (resistance in multiple) is provided, which will reduce the compounding to the desired amount.

If a more exact solution is deemed necessary it will be necessary to calculate the required full-load flux and full-load densities in the various parts of the magnetic circuit and then recalculate the ampere-turns necessary to give this required full-load voltage. The difference between the no-load ampere-turns and the full-load ampere-turns would then be the number required in the series field.

$$N_t I_t = N'I' + K_4 N'I' \quad (68)$$

$$N'_s I'_s = N_t I_t - NI \quad (69)$$

$$N_s = \frac{N'_s I'_s}{I_s} \quad (70)$$

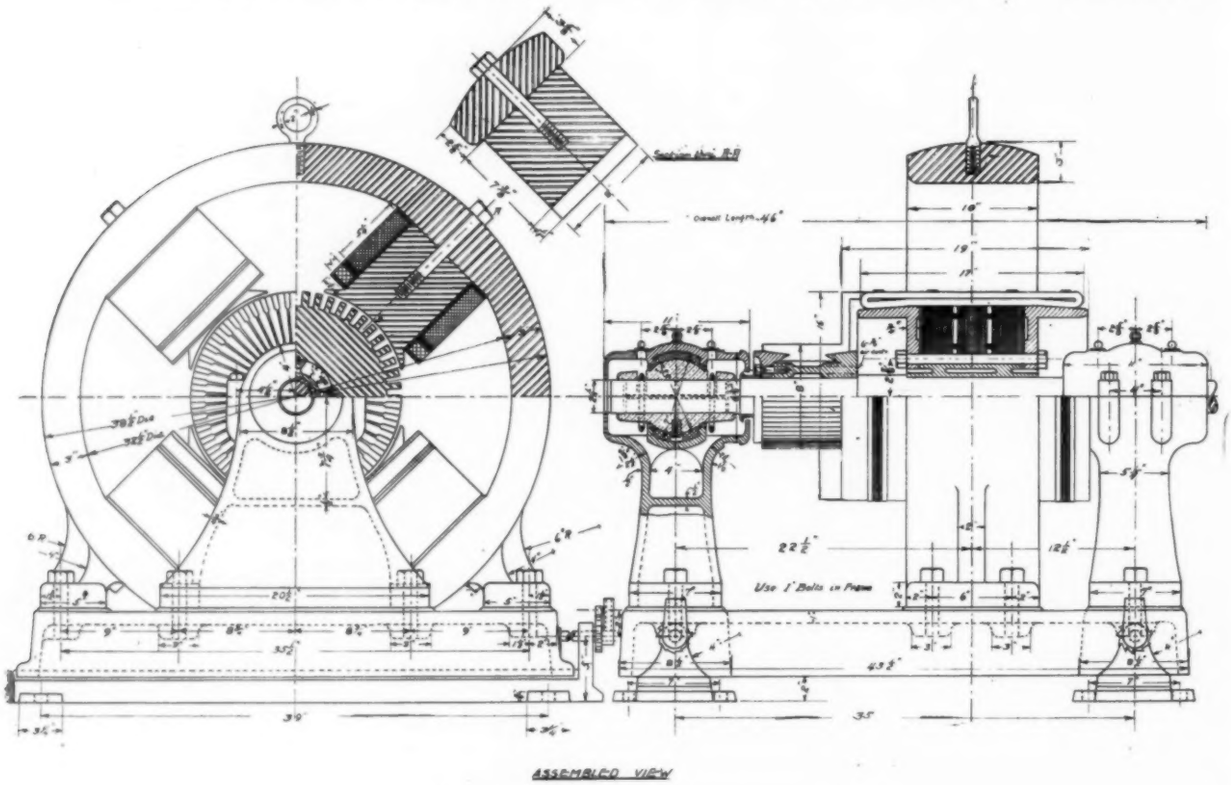
where $N_t I_t$ = total number of ampere-turns.

K_4 = per cent compounding.

$N'_s I'_s$ = total number of series ampere-turns.

TABLE XVII.

LOAD IN PER CENT	Armature I^2R	Series I^2R	Shunt I^2R	CORE LOSS	BRUSH FRICTION	WINDAGE AND BEARING FRICTION	TOTAL LOSSES	EFFICIENCY IN PER CENT
0								
25								
50								
75								
100								
125								
150								



THIRTY-KILOWATT, DIRECT-CURRENT, COMPOUND DYNAMO.
125 Volts, 600 Revolutions per Minute.

NI = total number no-load ampere-turns.

N'_s = number of series turns.

I'_s = series field current.

Determine the size of wire in the series field by using from 750 to 850 circular mils per ampere. Check the temperature rise of the series-field coil by equation (56).

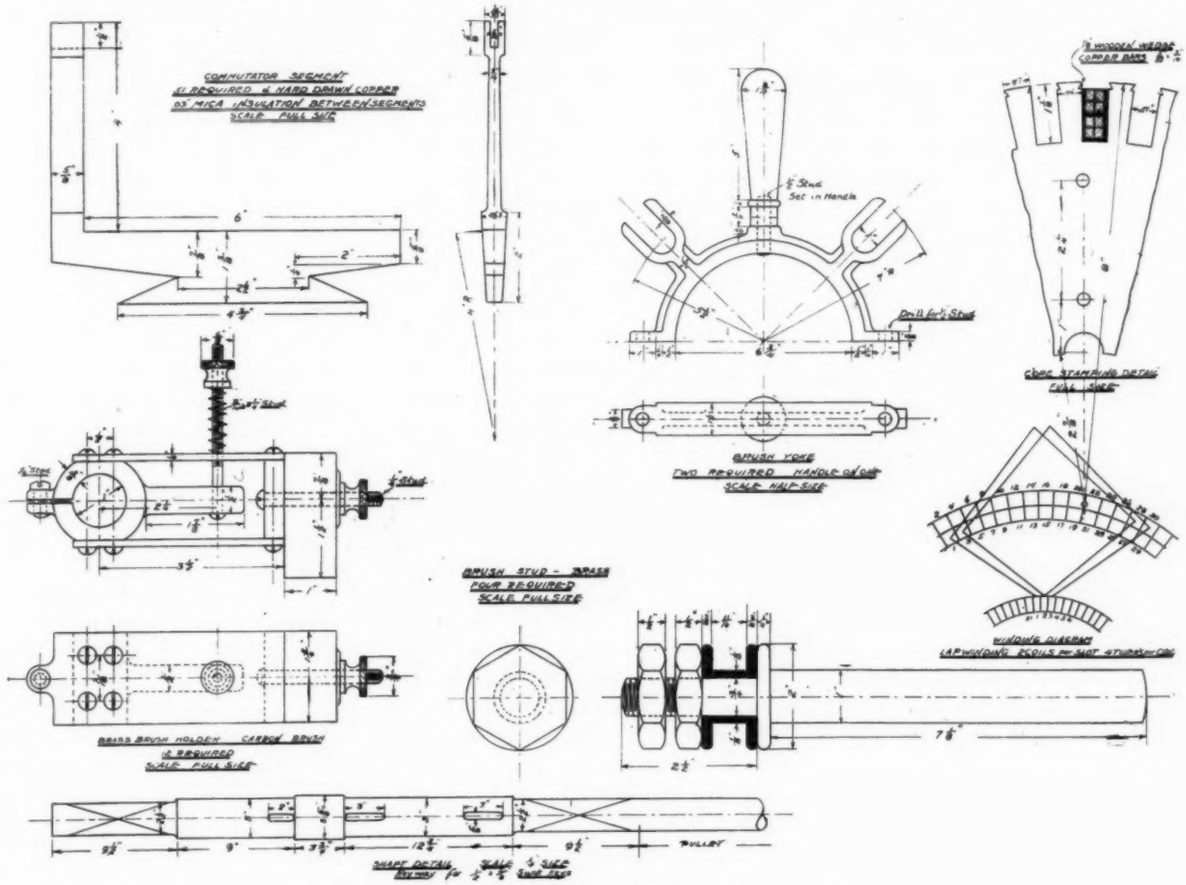
(R) Efficiency.—Assume the windage and bearing-friction loss and calculate the efficiency at various loads. This loss will vary from one to three per cent for high-speed machines and from one-third to one per cent for low-speed direct-connected machines with good alignment.

Tabulate the losses and efficiency as indicated in Table XVII.

From the data in the above table for armature, copper and core losses, the temperature rise at different loads may be found.

From the above data curves of efficiency and temperature rise for continuous operation at the different loads may be plotted, and the variable and constant losses shown by curves. The mechanical details should be worked out on the drawing board.

The accompanying illustrations are made from some dynamo designs worked out by senior students in electrical engineering under the guidance of the writer and applying the method laid down above.



DETAILS OF THIRTY-KILOWATT DIRECT-CURRENT DYNAMO.

Practical Standards for Electrical Measurements.

The report of the Committee on Practical Standards for Electrical Measurements, presented at the recent meeting at Sheffield, England, of the British Association for the Advancement of Science, covered principally the international co-operative work on electrical standards that has been carried out this year at the Bureau of Standards, Washington, D. C. The principal object of the research work was the determination of the electromotive force of the Weston normal cell in terms of the international units of resistance and current. It is stated that the results obtained are of the utmost value. A full report is being prepared.

Professor Laporte's research on the silver voltameter, conducted at the Laboratoire Central d'Électricité, gave the electrochemical equivalent of silver as 1.11829 milligrams per coulomb. The current was measured in terms of the Weston cell as 1.01830 volts at seventeen degrees centigrade, and the international ohm as realized at the National Physical Laboratory. The professor's value agrees closely with the figure 1.11827 as obtained by the British investigators.

The committee recommended that it be reappointed, with Lord Rayleigh as chairman and R. T. Glazebrook as secretary. An appendix to the report contains the Order in Council relating to Electrical Standards.

Expensive Railroad Construction.

It is estimated that the projected extension of the Central London Tube Railway, from the Bank of England to Liverpool Street, under the most expensive section of the business part of the city, will be built at a rate of about $5,000,000 per mile.

CENTRAL-STATION PRACTICE

Transmission—Interior Wiring

ELEMENTS OF POWER-STATION DESIGN.—V.

THE SELECTION OF PRIME MOVERS.—II.

BY W. B. GUMP.

Exhaust-Steam Turbines.—It is well known that the expansion of steam in a cylinder engine is quite limited, due to the fact that the size of cylinders required to take advantage of the full amount of energy is mechanically impracticable. In a steam turbine, however, the expansion can be carried to its limit; in other words, the toe of the expansion curve can be made to produce useful work. On this account the exhaust-steam turbine is being installed in a large number of reciprocating plants, and has been a means of utilizing a large proportion of energy which heretofore has been a waste. An addition of exhaust-steam turbines is equivalent to added boiler capacity, and on account of the small floor space these turbines are installed with less inconvenience than would usually be the case in extending the plant by other means.

The Gas Engine.—The advent of the gas engine into the central-station field is not only creating intense interest among engineers and power users, but is compelling most careful consideration in the choice of prime movers where formerly gas power was not thought of.

The chief objections to the gas engine in large units have been: (*a*) Non-uniform speed. (*b*) Inability to carry overloads. (*c*) Unreliability of service.

The first item, that of non-uniform speed, is decidedly objectionable as a quality for the generation of electric power. This introduces the much discussed question of gas-engine governing, which is a broad field in itself, and in this treatise can be dealt with only in outline. As it is an important item in power-plant operation, the fundamental facts regarding it should be thoroughly understood by those who are called upon to select a power-plant equipment.

Constant velocity of rotation signifies isochronism, and the nature of the gas engine is such that this is less closely approached than in either the steam engine or steam turbine. Taking first the case of the four-stroke cycle, it will clearly be seen that there can be but one impulse for every two revolutions. The governor will therefore respond either before or after two complete revolutions. With a sudden overload the effect of the governor cannot take place instantly; that is, not before the cycle of operation is complete. The propelling force is a series of sudden impulses which do not occur frequently enough to affect sensitive governing. To overcome this difficulty the tandem and double-tandem types are employed. In these the uniformity of speed is considerably improved, yet the limitations are comparatively narrow compared to the steam engine, and more especially so compared to the turbine.

Another element of disadvantage in the gas engine is that a change in the mixture of gas has more restricted limits relative to change of power than would seem to be best for heavy load fluctuations. For example, the speed will be reduced by a rich as well as a lean mixture. The result is that a comparatively short range exists between a very lean gas and a mixture which produces maximum power.

On account of the properties just referred to, a gas engine is not qualified to take overloads to exceed fifteen or twenty per cent of its rated capacity. For this reason a gas power plant is not ordinarily suited to heavy load fluctuations, as in railway service, unless operating with dissimilar units such as steam engines or turbines, or in conjunction with a storage battery. By increasing the weight of the flywheel the objections above cited may be partially offset, but even with this provision they are not entirely overcome.

With reference to parallel operation with other prime movers, the gas engine is not highly satisfactory under present methods of operation. Of the four methods of drive, the steam turbine, steam engine, waterwheel and gas engine, the last is probably the least sensitive in response to changes of load. When operating with waterwheel units a gas engine should preferably carry a constant load equal to its rating, and allow peaks to be taken care of by the waterwheels. This combination will evidently be confined to a short working range as compared to parallel operation with steam turbines, in which case sudden fluctuations are taken up by the turbine before the gas-engine governor can take effect.

Combination Plant.—Mr. Stott has suggested a combination plant made up of an equal number of gas engines and steam turbines, the latter using steam generated from boilers having their feed water supplied from the gas-engine jackets.

In considering such a proposition it is interesting to note several important items, among them: (*a*) Quantity of jacket water. (*b*) Quantity used for steam turbines. (*c*) Cooling water for condensers. (*d*) Load factor.

The quantity of jacket water required by a gas engine varies from eight to fifteen gallons per brake-horsepower per hour, or from approximately eighty to 170 pounds per kilowatt-hour, depending upon the initial and final temperatures and also upon the number of cylinders. Let us assume first that the turbines are to run condensing. The steam consumption for a 1,000-kilowatt unit would be, say, twenty pounds per kilowat-hour, including auxiliaries, which is approximately one-fourth the minimum quantity of cooling water per kilowatt-hour coming from the gas engines. In other words, when operating under full-load conditions, three-fourths of the cooling water passes from the jackets as a waste and only the remaining fourth is used for power. This would seem to indicate that four-fifths of the capacity of the plant should be made up of turbines, with but one-fifth in gas engines,

the latter being used virtually as a feed-water heater for the steam plant. With this arrangement all of the jacket water would become available provided the load-factor were favorable to a large average total steam consumption. This assumes that the gas-engine portion is taking only its rated load, and operates continuously. The load-factor would unquestionably have to be considered in laying out a plant of this kind, as this would have a direct relation to the ratio of gas power to steam power. A further increase in economy could be affected by allowing the exhaust gases to enter an economizer or discharge into a specially constructed boiler, thus utilizing a considerable quantity of heat which would otherwise be rejected.

At such times as the steam side of the plant is running light the greater quantity of gas-engine jacket water will be going to the cooling tower, or otherwise rejected.

Supposing now that the turbines are operated noncondensing, we shall find that the steam consumption is increased from fifty to seventy-five per cent. In other words, the available steam power is but little more than half the amount in the former case. With a sufficient quantity of circulating water the desirability of running condensing needs no argument, since only a small proportion of power is required for the auxiliaries.

Admitting that considerable economy may be derived from a combination gas and steam plant, there still remains the fact that a plant having dissimilar units is bound to be hampered by difficulties not encountered in a uniform layout. Nevertheless, it is instructive to speculate upon such a proposition and it is not unreasonable to suppose that this form of plant may be made practicable as the operating efficiency of gas-driven prime movers continues to advance. The floor space required by a gas engine of a given capacity and speed is considerably greater than that of a reciprocating steam engine of the same rating; hence the cost of the building is increased. Compared to a steam-engine plant the increase in space required would be from ten to thirty per cent. If this is compared to a steam-turbine plant the size of the building would likely be doubled.

The producer-gas power plant is accompanied by further objections which are chargeable to the gas producer. This piece of apparatus has not been wholly reliable, and consequently is more or less of a barrier in the way of continuous service even when the other appliances to which it is connected are entirely satisfactory. While the gas producer is unquestionably practical, yet its development has not reached the point of reliability desired. Furthermore, a high degree of skill is demanded in the operation of producers, and as the field is a new one the attendants for this work are not readily secured. Satisfactory operators are to be found only among those who have devoted their entire attention to producer gas. From these facts it is clear that special training is required to secure skilled operators, and this introduces a new problem which in a measure has retarded the development of gas power.

Notwithstanding numerous objections to the gas engine its successful operation in many large plants is conclusive evidence of reliability, and its use is becoming so extensive that the near future will doubtless record gas-power installations which will mark a new epoch in power development.

Comparative Investments and Costs of Operation.—Comparing first costs of steam engine, gas engine and steam-turbine plants in capacities above 1,000 kilowatts, we find the steam turbine to be generally the cheapest by all odds. For plants of 1,000 kilowatts the figures in the table will give fairly close approximations:

Kind of Plant—	Investment per rated Kilowatts.
Steam Engine	$110.00
Steam Turbine	95.00
Gas Power	150.00

Regarding operation and maintenance it may be stated that the reciprocating-engine plant will as a rule be the most costly. This is due to several items, such as number of attendants, repairs and supplies. With a turbine plant the number of attendants required is materially less. As an example, the writer is familiar with a steam-engine plant having three units, giving a total plant output of 20,000 kilowatts. In this plant there are nearly 100 men on the pay roll, including the night shift. Thus the engine economy is largely offset by abnormal fixed charges. In a steam-turbine plant of a trifle greater normal output (21,000 kilowatts) the number of attendants is about twenty-five men. The floor space in the turbine room is not more than half the size of the engine room of the former plant. Here two important factors have been reduced to such an extent that the advantages need no comment. The repairs in the turbine plant have been remarkably low as compared to those of the engine plant. These three factors, floor space, operators required and maintenance, show the present position held by the steam turbine in large power stations.

As to the gas-engine plant, data are somewhat difficult to obtain, but one is fully justified in concluding that the maintenance and cost of operation are fully as low as in the turbine plant, and due to fuel economy may be still further reduced in many localities.

It is contended that with the combination turbine and gas-engine plant the operation and maintenance can be brought to a minimum. This is based upon the assumption that the heat energy wasted is considerably less than in either the turbine plant or gas-engine plant alone. On account of the fact that such a plant has not actually been installed, the question of maintenance introduces factors which are too uncertain to be determined accurately. Future developments will no doubt reveal many features concerning economy, which at present are too obscure for a reliable analysis.

Engine Operation on Blast-Furnace Gas.—The operation of gas engines on carbon-monoxide gas in connection with the steel industry has given assurance of the practicability of gas power. Several plants of this kind have been in operation for a sufficient length of time to demonstrate the utility of the gas engine in deriving power from a source which might otherwise be a total waste or at best could not be utilized to the degree made possible by the gas engine. In several of these plants the generation of electric power by direct connection to gas engines has been made a marked success, and this is the natural consequence of persistent effort on the part of those called upon to solve some of the problems mentioned in the foregoing discussion.

(To be continued.)

A dispatch from Kingman, Ariz., states that the erection of another unit to the local power plant, doubling its capacity, is now under way. The concrete foundations have been completed and the additional power is expected to be available by the first of next year. The power is used almost exclusively for mining purposes.

CENTRAL-STATION ECONOMY.—III.

EXHAUST STEAM.

BY P. E. MATTESON.

There are many degrees of economy obtainable in central-station maintenance. For example, a piece of apparatus might be installed which would cut the cost of production ten per cent while another apparatus could have been installed which would cut the cost of production twenty per cent, by performing that particular operation more efficiently. Even though the first apparatus effects considerable saving it is not efficient or economical since it leaves such a large margin of additional efficiency obtainable.

This condition is perhaps most noticeable in the utilization of exhaust steam. The reason that exhaust steam is so frequently misused is because there are so many uses to which this steam can be put, but the economy of any of these possible uses depends upon the conditions under which the central station is operating.

Feed-water heating by exhaust steam is accomplished by piping the engine exhaust through a receptacle into which the boiler feed is introduced, and the heat in the exhaust is transferred to the water. Steam from a simple engine is exhausted at about atmospheric pressure (or 14.7 pounds absolute pressure), and contains at this pressure about 966 units of heat. The amount of feed water which one pound of this exhaust would heat is easily calculated. If the feed is to be heated from seventy degrees to 200 degrees Fahrenheit, 130 heat units are required to heat each pound; at this rate each pound of exhaust steam will heat about seven pounds of feed water allowing for some heat to be lost in the heater.

Another apparatus which is frequently used to obtain work from exhaust steam is the condenser. A condenser is an apparatus in which a vacuum is formed by bringing the steam into contact with cold surfaces. Steam at atmospheric pressure has a volume of nearly 1,700 times as great as the same weight of water, and as a consequence, with steam suddenly chilled and condensed to occupy only one-seventeen-hundredth of its original volume, if this condensation takes place in an air-tight receptacle, the result will be vacuum.

As stated before an engine which exhausts into atmosphere exhausts at a pressure no less than atmospheric, but if an engine is permitted to exhaust into a vacuum such as created by a condenser the steam can be worked down to the absolute zero of pressure. The reason for this larger range of pressure is because the steam introduced into the engine cylinder does not have to contend with the pressure of nearly fifteen pounds per square inch against the piston as is the case with the noncondensing engine, and is capable of doing just that much more work.

The saving by the use of condensers is from fifteen to twenty per cent in the operation of the engine but not necessarily so high in results upon the entire plant. The reason for this is that although the engine is operated more efficiently, the cost of operating the condensers is quite high, in fact it could be so high as entirely to overcome whatever saving there might be effected in operating the engine. The largest item against the condenser is water, over thirty pounds being required to condense each pound of steam, which means that unless an unlimited supply of the cooling fluid be at hand, the cost of obtaining this water would more than overcome the gain in engine operation. It is also necessary to use pumps in connection with the condenser, both to supply the cooling water and remove the condensed steam from the condensing chamber, and if care is not exercised in the operation of these pumps they might waste all the steam saved in the engine.

Unfortunately the engine exhaust cannot be used both to heat the boiler feed and create the necessary vacuum in the condenser because if the so-called cooling water becomes heated to any extent it fails in its purpose as a condensing fluid and the vacuum is lost. But it is possible in a condensing plant to heat the feed water from other sources quite economically. As stated above it is necessary to use pumps in connection with the condenser, and as pumps use steam in proportion to their power the exhaust from these alone is sufficient to heat the feed several degrees.

Still another means of utilizing exhaust steam is the low-pressure turbine. The operation and theory of the low-pressure turbine are quite simple. Steam performs work by expansion and the amount of work that steam is capable of performing depends, not so much upon the pressures between which steam expands, but upon the number of times that it is expanded. For this reason the compound engine which takes advantage of several expansions is a very efficient piece of machinery above atmospheric pressure, but on account of the extremely large cylinders necessary to take advantage of any expansions at the low atmospheric pressure, the reciprocating engine cannot be used for this work, but the turbine can take advantage of expansions down to the lowest pressures.

The low-pressure turbine can take the exhaust from a reciprocating engine at about atmospheric pressure and expand the steam down to twenty-six or twenty-eight inches vacuum by exhausting into a condenser. The turbine requires no additional steam or boiler capacity, as it merely makes further use of the same amount of steam already used.

The efficiency of these turbines is very high since they develop as much power through the expansion of steam below atmospheric pressure as a reciprocating engine will by expanding steam from 150 pounds down to 14.7, and may even double the output of a noncondensing steam plant. Of course a low-pressure turbine cannot be used without a condenser and consequently any objections to the installation of a condenser would also be present in the installation of the turbine; but since the turbine is so very efficient it should overcome every objection that could be made against the condenser.

Conditions for maximum economy can be summarized as follows:

Feed-water heating would be most economical in a plant which had sufficient capacity but suffered from expensive fuel, or feed-water heating would prove economical in any plant which could not use the exhaust for any other purpose.

Condensation would prove economical wherever abundant water could be obtained or would be beneficial in a plant requiring fifteen or twenty per cent more power.

The low-pressure turbine would be a source of economy in any plant which could use the increased capacity made possible by these machines.

ELECTRIC LIGHTING and ILLUMINATING ENGINEERING

ILLUMINATION AS A FACTOR IN MANUFACTURING COSTS.[1]

BY A. S. HUBBARD.

The three important elements of the human machine are the brain, the eyes, and the fingers. The eyes perceive, the brain directs, and the fingers execute. Ocular perception is the first and one controlling act upon which the final results of the human mechanism absolutely depend. To enable the eye to perform its function with the greatest possible ease and accuracy is therefore of first importance in any consideration of the conditions determining operative efficiency. To provide an illumination both natural and artificial, that shall secure this end is therefore a problem worthy of the most serious study.

The adequacy or efficiency of any system of illumination must be judged by the extent to which it enables the eye to perform its functions without undue strain and effort. This fact cannot be too strongly emphasized, especially in view of the prominence that has recently been given to the mechanical efficiency of artificial lighting installations. The amount of illumination produced on a given surface from a watt of electric current, is of some interest and importance, but its importance is wholly secondary to that of the efficiency of the human machine in relation to the illumination by which it operates. Compared with the cost of labor and the value of the product turned out, the cost of producing artificial light is so insignificant a factor as to make its serious consideration ridiculous. A simple reckoning will make this point clear.

We may assume that the cotton mill of today is supplied with electric current from its own generating plant, and that therefore the cost of such curent, exclusive of fixed charges, which remain practically the same whether much or little current is used for light, will not exceed one cent per kilowatt-hour. One kilowatt for one hour is equivalent to 100 watts for ten hours. One hundred watts will supply two ordinary sixteen-candlepower incandescent lamps, or one eighty-candlepower tungsten lamp, or more than one-fifth of an arc lamp, or more than one-fourth of a Cooper Hewitt lamp. In other words, if every operative were given two carbon-filament lamps or one tungsten lamp for his own exclusive use, or one arc lamp was provided for each five operatives, or one Cooper Hewitt lamp for each four operatives, the cost of current for the entire day would be one cent for each operative. Suppose the average wages of the operative to be $2.00 per day of ten hours, to make reckoning easy. This is twenty cents per hour, or one cent for three minutes; therefore, an operative would have to lose but three minutes' time to represent a money loss equal to the cost of more light than he would need for an entire ten-hour day. How much of an imperfection or curtailing of product would it take to represent one cent?

Of course, we must add to the cost of current the cost of upkeep of the lighting installation, including depreciation, maintenance, etc.; but this will certainly not exceed the cost of current, and we can double our figures for the cost of light without any material effect upon our argument.

The question whether we use one-half a watt or two watts per square foot of floor area, or whether a lamp costs fifty cents or $50, is a trifling matter, when the whole cost of production is considered, compared to the question of the efficiency of the human machines upon which the product of the mechanical equipment depends. Any discussion of the lighting problem which fails to take this into account is fatally superficial and misleading.

The operative in the cotton mill has two general objects of vision, viz., the material being handled, and the machine which is handling it. That illumination will be the best which enables the eye to follow both of these objects, as occasion may require, with the greatest ease and distinctness.

There are certain general conditions which must be observed for all uses of the eye. These are: the proper intensity, which is the happy medium between dimness and dazzling brilliancy; absence of glare, that is, absence of brilliant light-sources in the line of vision; steadiness, absence of flickering or wavering or light and dark spots on the illuminated surface; and freedom from injurious invisible radiations.

The general relation of light to the eye must necessarily be understood before the general requirements for satisfactory illumination can be determined. The eye consists of two sets of parts, one set of which makes up an optical instrument very similar to the photographic camera; the other is made up of an exceedingly delicate and complicated arangement of muscles, nerves, and brain cells, which convert the photographic image into mental impression called vision. Defects in the physical, or instrumental part of the eye are often corrected with glasses, or by surgical operations, or both; injuries or strains of the physiological part are vastly more difficult to treat, and more far-reaching in their effects. The physiological part of the eye is subject to muscular, nerve, and brain fatigue, in any of which, if the fatigue be unduly severe or prolonged, inflammation and pain will result; and if these be sufficiently acute or prolonged, permanent injury will follow.

The optic nerves, with their brain centers, are not only important physical organs themselves, but are so closely connected with other nerve systems of the body that it is impossible for them to suffer without the other nerve systems being affected sympathetically. It is also a well established fact that the color of light has a strong influence

[1] Extract from a paper presented before the National Association of Cotton Manufacturers at its semi-annual meeting in Portsmouth, N. H., September 17, 1910.

upon the general mental condition, producing either depression or elation of spirits. Thus red produces excitement, activity; yellow may be considered neutral, the yellow rays being the most effective in producing the simple visual sensation; green is distinctly restful, giving a sense of peace with a suggestion of coolness; blue and violet are depressing, as the common phrase, "feeling blue," bears evidence.

This connection of vision with other functions of the body has a direct and positive bearing upon the efficiency of the human machine, for the one essential difference between the human machine and the purely mechanical device is its possession of a brain upon whose action the operation of the machine is absolutely dependent. Put the brain out of commission, as by sleeping, or an anesthetic, or mechanical injury, and the human machine becomes a perfectly inert mass. To work at its maximum efficiency, it must not only have fuel in the shape of food to supply the motive power, but the brain must be in such a condition that it will direct the machine with the utmost accuracy and co-ordination.

With this brief survey of the eye and its functions, we will now take up the general conditions of light as effecting its use. First among these is the proper degree of brilliancy or intensity of illumination required for various classes of work. Fortunately, the human eye is capable of working to some extent through an enormous range of light intensities. It can see objects with a considerable distinctness by the light of the full moon, and with great ease by the light of the noonday sun; the latter is a million times as intense as the former. Such being the case, the happy medium by which it can perform its work best is included between comparatively wide limits.

The eye can see very comfortably, where it does not have to accurately focus, by an illumination of from one-quarter to one-half foot-candle. An intensity of such a degree should therefore be provided for passageways, storage rooms, and other places where close eye-work is not required. For careful vision on light colored objects, such as reading print on white paper, writing, etc., from two to four foot-candles is satisfactory, depending somewhat upon the age and individual condition of the eye. For careful vision on dark colors this intensity should at least be doubled, and where unusually careful vision is required several times this intensity is often used. These figures are based upon ordinary so-called white light, or its nearest equivalent. In light of different quality these intensities may be varied, as we shall see later.

Glare may be roughly defined as such an intensity in a luminous body as to produce indistinct vision of that body. In a general way, the extent of glare is measured by the amount of blurring of the vision, or the time required for the vision to be blurred when constantly looking at the object. Thus, if you look directly at an electric arc the effect on the eye is of seeing simply an intensely bright spot with indistinct outline. Cut down the brilliancy with smoked or colored glass, and you see that there is no such bright spot, but simply the ends of the carbons in a glowing state. This represents the highest degree of glare in any of the artificial light-sources. On the other extreme, if you look at a common candle flame steadily for a sufficienly long period the outline of the flame will become blurred, but with a normal eye this period would be considerable. This represents the minimum glare among the most familiar light-sources.

There are a few points in regard to glare which are generally overlooked. The immediate cause of glare is excessive brightness of a part or the whole of the image received upon the retina of the eye. It can easily be shown from the laws of optics that the brightness of the retinal image does not vary with the distance at which the object is seen. In other words, glare does not diminish with the distance as does intensity of illumination. An electric arc, for example, seen at a distance produces just as bright a spot on the retina as one seen near at hand, the only difference being that the spot is smaller. As the physiological effects depend upon the brightness of the spot rather than upon its size, it follows that glare does not diminish largely with the distance. Care should therefore be taken to keep bright light-sources out of the line of vision, no matter how distant they may be.

Glare may result from reflection from surfaces which produce images, but practically never from surfaces that reflect diffusively. The fact that a small image may produce troublesome glare applies particularly to reflected images. A drop of oil or a polished nickel thumb-screw, if it happens to be located in such a position as to throw an image of a light-source into the eye, may cause almost as much discomfort as if the source itself were in the line of vision. The prick of a pin, if persistent, may get on the nerves and be as annoying as a probe from a bayonet. Highly polished surfaces of every description should be avoided to the greatest possible extent wherever constant eye work must be done. This applies to both machinery and office furniture and fittings.

Steadiness of light is so evident and necessary that it is rarely overlooked; a flickering light immediately irritates and tires the eye. There is a modification of this effect, however, which is much less apparent but nevertheless troublesome, and that is a streaky illumination, such for example as that given out by a bare incandescent electric lamp with a polished reflector. An eye in running from light to dark streaks in the course of reading from one side of the page to the other has to readjust itself constantly, and hence the effect is physiologically the same as that of varying light. Illumination for the working field, that is, the space upon which the eye must focus sharply, should be perfectly uniform in intensity.

All light contains both visible and invisible radiations. Invisible radiations are of two kinds, those commonly called heat rays, and those that are known as chemical, actinic, or ultra-violet rays. Heat rays tire the eye when in excess just the same as an overheated room tires the body. Ultra-violet rays, by their intense chemical action, have a destructive effect upon certain tissues of the organs of vision; and this action may be exceedingly dangerous in cases where the rays are excessive. Since the sensational discovery of the so-called X-Rays by Prof. Roentgen, a great deal of attention, both in the scientific world and in the popular press, has been given to invisible radiations.

There has been some jumping at conclusions indulged in by scientific investigators as to the actual danger of the ultra-violet rays contained in modern commercial light resources. The most reecnt and reliable conclusions on this subject may be briefly stated as folows:

No commercial light-source at the

present time gives as large a proportion of ultra-violet rays as is contained in sunlight. Ordinary lead glass, such as is used for incandescent-lamp bulbs, tubes for mercury-vapor lamps, and in the better grade of globes, absorbs nearly all of the ultra-violet rays.

The danger from ultra-violet rays, especially in light-sources using lead-glass globes or containing chambers, is insignificant, most of the troubles attributed to the presence of ultra-violet rays being due to glare.

All of these general principles have been recognized for some time, at least since illuminating engineering became a distinct branch of science. It is only recently that another very important element in the progress of vision has attracted the attention of those who have studied lighting problems. This element is the quality, or character, of the visible radiations emanating from a light-source. On this basis, all light-sources may be divided into two classes: those in which the radiant, or luminous body, is a solid; and those in which it is a gas or vapor.

In the first class are included all forms of gas or oil lamps, and all forms of electric lamps except the mercury-vapor, or Cooper Hewitt lamp and the vacuum tube, or Moore light, and to a very slight extent the flaming-arc lamp. The light from an incandescent solid contains all the different kinds of radiation that are found in sunlight, although not in the same proportions; in other words, it presents a continuous spectrum of colors, like that of the rainbow, which are accompanied by both heat and ultra-violet invisible radiations.

The mercury-vapor lamp differs from all other sources in giving no red rays whatever. Consequently, the light is of a bluish-green color. Being the most highly efficient of all electric light-sources, it follows that it contains a less proportion of heat or luminous rays. By reason of its distinct color it changes the apparent color scheme of all objects which it illuminates, color being a relative quality depending entirely upon the color of light by which the object is viewed.

The most remarkable feature, however, of light of this quality is the greatly increased acuity of vision which it affords; that is the eye can distinguish or resolve, as the occulist would say, fine objects or details with greater ease and distinctness by the light of the mercury-vapor lamp than by any other luminant in commercial use at the present time. Several different scientific explanations have been offered to account for this fact but they are of no practical consequence to those using the light. The fact is unquestionable, and susceptible of instant proof, all that is necessary being simply a comparison of some object containing fine details, such as a piece of fabric, under light of this quality and under light containing all the colors. Such a test will lead inevitably to the very remakable conclusion that the bluish-green light of the mercury-vapor lamp produces sharper vision than even daylight under the best conditions.

Another peculiarity of light of this quality is its ability to render objects clearly visible at lower intensities of illumination than is possible with white, or ordinary quality of light. This fact has been known for some time, but has come into practical importance only with the commercial use of the Cooper Hewitt lamp. The result of this peculiarity is that the shadows are much less black or dense in the case of such light than by that of any other light-source, the density of a shadow being determined by the extent to which it obscures vision. While illumination by Cooper Hewitt lamps is not shadowless in a literal sense,—a condition which, be it remarked, is highly undesirable—the shadows are never troublesome for the reason already given.

Again, objects can be distinguished at a greater distance by bluish-green light than by light containing red rays. Lastly, the eye works, other conditions being equal, with less effort, and consequently with less fatigue, by a light of this quality than by light containing all the rays, for the reason that the red rays are the least effective in producing vision in proportion to the amount of energy they contain.

Having thus reviewed the general conditions affecting artificial light, we now come to a consideration of the special conditions arising in the illumination of textile mills.

The fact is self-evident that the prime requisite in at least ninety-nine per cent of the operations in textile manufacture is distinctness of vision. The raw materials are made up of exceedingly fine fibers, and in almost the entire process of their treatment the eye must be focused carefully upon objects in which fineness of detail is the chief characteristic. As the efficiency of the human machine depends very largely upon the quickness and distinctness of the visual impression, it follows that, other things being equal, the quality of light which affords the greatest acuity of vision must be the best. In the case of the light of the Cooper Hewitt lamp there are a few cases in which other things are not equal. These are the cases where color values, as they appear by daylight, must be distinguished. Such cases are much fewer than would be imagined at first thought. In the majority of processes color distinctions do not enter into the problem of vision, the only requirement being to see the details of the object or objects worked upon.

Besides the very manifest advantage of this sharpening of vision possessed by bluish-green light, there is also, fortunately, in the case of the Cooper Hewitt lamp, practical freedom from glare without the use of diffusing globes, the intensity of the incandescent mercury vapor not being sufficiently high to give harmful or annoying results.

The question as to the relative advantages of general and special illumination has been much discussed by illuminating enginers; but it is of entirely subsidiary importance to the question of quality of light as affecting the visual organs. With a light-source that is one of dazzling brilliancy, it is of course essential that it be kept out of the line of vision, and this is best accomplished by covering it with some sort of reflector placed so as to direct its light over the special field of vision. Such directed light is evidently not as agreeable to the eyes as a generally diffused light of the character of daylight; so that a general illumination produced without glare must be accepted as the preferable method.

As stated in the outset of this paper, the cost of illumination and its mechanical efficiency is really of trifling importance; it may, nevertheless, come in for a share of consideration. While some differences may be made by very careful engineering, in general the efficiency of the lighting installation will be determined by the efficiency of the light-producing units. The following table is taken from one of the latest

and most authoritative works on illumination:

Type of Lamp—	Watts per Spherical Candle (total flux).
Carbon Incandescent	3.6 to 4.1
Gem Incandescent	3.1 to 3.5
Tantalum Incandescent	2.49 to 2.71
Tungsten Incandescent	1.68 to 1.83
Inclosed Arc	2.6 to 3.0
Magnetite Arc	0.75 to 1.0
Flaming Arc	0.28 to 0.5
Cooper Hewitt	0.48 to 0.6

The saw-tooth roof construction is now generally utilized for weaving rooms in strictly modern factories for the reason that it gives the best possible distribution of daylight illumination, producing a uniform intensity over the entire space, and still giving a directed light, the effect being perceptibly different from that of a flat skylight. The ideal disposition of artificial light-sources is to place them in the angles of such a roof so that they will be out of the direct line of vision of the operatives.

Cooper Hewitt lamps thus placed constitute the full equivalent of daylight. This may sound like an extravagant claim to make for any artificial light-source, but both scientific theory and practical usage substantiate it. The scientific reasons have already been stated in some detail, and the practical results have been verified in numerous installations. In a number of cases of the largest textile mills in the various lines in this country, it has been found by careful records running over considerable periods that, with proper illumination from Cooper Hewitt lamps, the product during the hours when artificial light is used exclusively is fully equal in both quantity and quality to that produced under the best daylight conditions. The increased efficiency represented by such conditions over those formerly existing has run from eight to twenty per cent.

By far the large part of the cost of any finished article is labor cost. To increase the efficiency of the laborer, or the human machine, is therefore first in importance in considering methods of reducing manufacturing costs. Two things contribute to this efficiency: machinery and facilities, and the skill and will of the operator. It is useless to expect a laborer to turn out his best work with poor tools. It is the part of economy to supply the best tools with the best facilities for using them, and among such facilities light stands first.

But the human machine must have the will to work, as well as the opportunity and facilities. This is partly conscious and partly sub-conscious. The conscious will is largely the result of the rate of wages; the sub-conscious will, which especially affects the quality, depends upon interest in the work, contentment with conditions nad physical health, especially of the nervous system. The two latter conditions are dependent to a large degree upon light and ventilation. So that both from the material and the psychological viewpoints illumination stands foremost among the factors determining the efficiency of the human machine, and consequently the total cost of production.

The Improved Street Lighting in Philadelphia.

Mention has been made in these columns recently of the extension of the new street lighting system in Philadelphia's down-town district. Including those erected in Market street, east of the City Hall, last winter, the number of new lamps installed during the year is 1,129. The lamps are direct-current, 2,000 candle-power arcs hung in pairs on ornamented iron columns twenty-two feet high, the globe being about eighteen feet above the pavement. The price of each column is about $95.

ACCEPTED DESIGN FOR INDEPENDENCE SQUARE LAMP-POSTS.

The Philadelphia Electric Company has a contract with the City of Philadelphia for the installation, lighting and maintenance of the new lamps at $100.06 per year. The company has borne the entire cost of the new conduit lines, lamp-posts and lamps. The lighting of the new lamps thus costs the city annually $112,967.74. For the 11,931 old lamps in service throughout the rest of the city $1,193,815.86 is paid per year, thus the total annual street lighting charge of the city is $1,306,783.60.

The design shown herewith has been adopted for the new memorial lamp-posts about Independence Square. It follows very closely an original design drawn by Chief McLaughlin, of the Electrical Bureau, who suggested the memorial project as part of the new lighting scheme for the center of the city. The standard is strictly colonial in design. Each base will bear in bold relief the name of one of the signers of the Declaration of Independence, surmounting a bronze relief plaque of the City's coat of arms. Fifty-six of these standards will be erected around the square bounded by Chestnut, Walnut, Fifth and Sixth Streets. They are to be completed by New Year's Eve.

Electric Lighting of Constantinople.

The technical commission of the Turkish Ministry of Commerce and Public Works, charged with effecting a classification of the different competitors for the concession for the electric lighting of Constantinople and suburbs, has just finished its work. It seems, judging from the results, that this task has not been easily accomplished. It was not expected to be so, considering the diversity of the projects and the total absence of a common standard by which to judge the advantages offered by the different competitors.

The commission was divided into two groups. Two classifications were made. Of the eight bidders, some of whom were syndicates, seven were accepted in each of the classifications. As the two lists did not agree regarding the order of the bidders, it will be necessary to submit all the bids to an adjudicatory commission for final selection of the successful bidder.

It is impossible to foresee who will secure the concession, as there is nothing to indicate the considerations which will guide the commission and the elements which will serve as a basis for the definite choice of the Minister. After the concession is awarded the successful competitor will be obliged to carry out the work of installation within eighteen months.

TELEPHONY—TELEGRAPHY, and WIRELESS.

TELEPHONE TRAIN DISPATCHING.—II.

LINE CONSTRUCTION.

BY K. W. ENDRES.

The arrival of the telephone among the railroads for dispatching trains has also been a prolific cause for the advent of new methods, new ideas and new material in their line construction. While it has been done gracefully, nevertheless the telephone has been responsible for many improvements in raiload wire service. By its own needs it has forced changes—some of them almost revolutionary from the old telegraph man's point of view—but all of them advances in the art.

It is not intended to cover here the whole number of the changes which have been introduced; that is, beyond the scope of one paper. There is, however, one feature which it is fitting to deal with first, because it is what the railroad which goes into telephone dispatching meets first of all. That is the line.

Now "ye olde telegraph manne" has been building pole lines and stringing wire for years and it sometimes strikes him as strange that the telephone should commence by interfering here in a province with which he is thoroughly familiar, and sometimes he resents it. But here is where the telephone has to teach its first lesson and incidentally make its initial move in diplomacy. A telegraph and a telephone circuit are two entirely different propositions.

The telegraph cicuit occasionally, it is true, is of copper, but much more often, especially in railroad work, it is of iron with wrapped joints. Frequently also these joints are not soldered. The telegraph circuit is a single wire working from ground to ground. It also is a much less sensitive circuit than is required in telephony. High-resistance joints can be cared for by raising the voltage, leaks to ground can be handled in the same way together with adjustment of the artificial line in the telegraph office; likewise the effect of the wet weather. The sole object to be accomplished is the operation of a relay or relays at the distant end and provided this is effected, voltage, current, capacity and resistance are of small account.

By this it is not intended to state that they are neglected, far from it, but a difference in voltage between 40 and 400 volts is merely the difference betwen a local and a trunk circuit in telegraph service. The point is that such differences can be cared for in telegraph work by electromechanical means. It is, of course, due to the fact that they can be thus easily cared for that the telegraph line construction along railroad rights of way has taken the form now existent. This construction has aimed to meet the requirements for successful telegraph operation and it has succeeded admirably. The pole line itself differs not at all in the two systems of communication. The difference comes when we get into apparatus and material affecting the operation of the circuits themselves.

In telephone work, particularly long-distance work, of the nature of which dispatching circuits partake, the factors outlined above exert a direct and very appreciable influence. The resistance of the wire itself affects that delicate quality known to telephone engineers as attenuation. In other words, high resistance thins out the spoken word until it disappears completely from hearing. The limit at which transmission is considered commercial —or the grade of speech a man will pay for and that will give him satisfaction, is taken arbitrarily at the equivalent of that obtained over 850 miles of No. 8 B.W.G. two-wire copper circuit with a telephone set at each end.

Railroad dispatching circuits run from fifty to 300 or more miles in length. It has been found, in fact, that many which start near 100 miles end up nearer 300, so great is the improvement in operating efficiency. On the above basis, No. 9 B. & S. copper has been adopted as standard for train wires on nearly all the railroads. This gives excellent transmission up to the greatest length of dispatcher's district which is met with in American practice. It is not always necessary at the outset, but experience has shown it to be the most economical due to the fact that the railroads are in many cases combining, and adding to the line handled by one dispatcher. It has also been found desirable to arrange train-dispatching circuits so that several can be joined together, forming one through circuit, for special purposes.

The telephone circuit is, of course, a two-wire circuit and all joints are made with copper sleeves, so that there is no chance for high-resistance spots to appear in the line with the consequent injury to transmission of speech. Further, in view of the fact that the telephone is the most sensitive commercial instrument known to electrical engineers, special care must be taken to prevent outside influences from interfering with its operation. These outside sources of disturbance in railroad service are most often the telegraph lines themselves, but frequently power, lighting and high-tension transmission lines are met with and parallel the talking circuit.

For ordinary cases of induction, namely, low-voltage power circuits and telegraph wires the familiar transposition scheme followed on all commercial telephone lines is sufficient. This in itself is a new development to the railroads who have been working with single wires for so many years. They are, however, employing the same methods used by the telephone companies, in some cases using single-pin

transpositions on a two-piece insulator, in others using one-piece insulators, one on the cross-arm and one on a hanging iron bracket. Since the telephone circuits are practically all new on railway pole lines, these transpositions are being made during the process of line construction and cutting the wires is thus avoided.

Where the telephone train wire is exposed to straight and duplex telegraph lines only, half-mile transpositions are generally sufficient. If two circuits are strung—a train wire and a message wire—these are made at alternate quarter-mile poles on each circuit. Where quadruplex telephone lines are met with and it is impossible so to locate the telephone circuit that it is a considerable distance from these, it will be found that more frequent transpositions are required, say every quarter mile on each circuit. It is advisable, however, always to place the telephone circuits as far away as possible from lines working quad, solely on account of induction.

The railroads are finding one of the great advantages of their telephone systems is that the trains can carry portable sets, which can be hooked on the line at any point in cases of emergency. With this object in view the question of providing an insulator of distinctive appearance for the telephone circuits is coming up today and porcelain promises to come into use. This material also has the great advantage of an increased insulation resistance over glass and, aside from the question of expense, is altogether most satisfactory. This is particularly true on telephone lines of this character for long-haul work.

On some short lines not exceeding 100 miles in length to any extent it has been found desirable as a matter of economy to arrange two of the No. 8 B.W.G. iron telegraph wires as a message circuit and to install telephone and selector equipment upon it. Then in event of breaks in the copper train-wire circuit, this iron circuit may be used to patch it up temporarily. It is necessary, however, before equipping such a circuit to go over the line most carefully, making the necessary transpositions and soldering all joints. It is not possible to phantom an iron and a copper circuit. For this reason alone the use of iron for such purposes is to be considered most carefully.

In order to get the maximum service out of a pair of telephone circuits these may be phantomed—using each pair of wires as one side of a third circuit—a matter accomplished very simply by means of repeating coils located at the ends of the line. Phantom circuits affect the line construction in that they require special transpositions to prevent cross-talk between the sides and the phantom. These special transpositions of each pair of wires forming one side of the phantom against the other side assist and complement the action of the phantom repeating coils in eliminating the conversation in the side circuits from the phantom. Thus three conversations can be carried on over two pair of wires at once without interference. The railroads are planning to take advantage of this and on many of them it is the custom to cut in the phantom transpositions about once per mile on the line when construction is in progress. This is done as a matter of economy whether the phantom circuit itself is put into service at once or not.

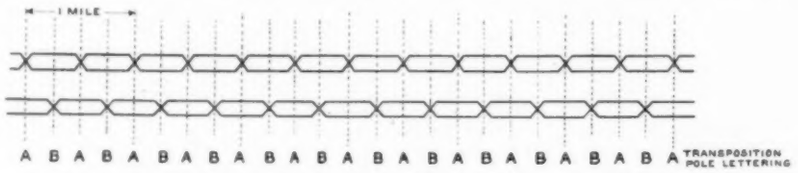


FIG. 1.—STANDARD TRANSPOSITIONS ON RAILROAD TELEPHONE LINES.

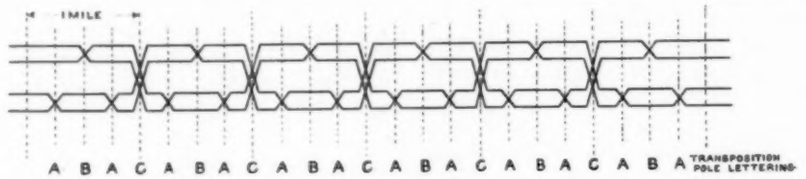


FIG. 2.—TRANSPOSITION SCHEME FOR TELEPHONE TRAIN AND MESSAGE WIRES WITH PROVISION FOR PHANTOMING.

The phantom circuit over train and message wires offers a road a very economical way of obtaining private telephone service between its important points. The extra expense involved is practically nil.

Drop wires for the telephone equipment are quite generally of No. 14 B. & S. braided, rubber-covered, twisted-pair wire. This makes a convenient and neat appearing method of looping into an office and can be carried on porcelain knobs. Where there are many circuits cable is used for obvious reasons. The usual practice in this work is to tap from the main line with either wrapped soldered joints or by means of test connectors. In case testing equipment is installed in the office, the line must be looped through this and therefore it is generally dead-ended in each direction and the office connections run in from both sides. Two-piece insulators are used for dead-ending the line, although, if poles are situated conveniently, it is better to terminate the line in each direction on separate poles.

The twisted-pair wire is carried to the under side of the cross-arm and mounted on porcelain knobs or run in wooden or porcelain cleats to the end where it terminates on a knob. On the building end this wire may either be terminated on a bracket-mounted insulator or a distributing ring. It is, of course, carried into the building in the usual way, but each wire should have its own porcelain bushing through the wall.

Many, practically all, of the above methods of construction are those in general use throughout the country in telephone work. They have been the result of years of experiment and years of experience to show what gives the best practical results. They are aimed in one direction—the construction of a good line, well insulated, without poor joints, sightly and economical both from a cost and a maintenance standpoint. The expense is, as in all such cases, a matter of compromise, but it has been made very evident that in pole lines, as in other things, the attempt to save money by cheap, poorly built equipment results in a greater expense in the end. The portion of the country under consideration will obviously modify construction methods to a certain extent, but it is only a modification. Lines in the sleet districts

will necessarily be more strongly erected, more firmly guyed than lines in the South. The effect of local influences is always felt, but the basic principles of line construction on which satisfactory telephony rests are always the same.

That the requirements in this newly developing railroad field are more severe than have heretofore existed is an advantage to the roads in that it leads them by degrees into better, more stable construction and more permanent wire lines along their rights of way.

(To be continued.)

Telephone Investigation in Texas.

The conditions surrounding the employment and work of telephone operators in the state of Texas, was the subject of a recent investigation made by the commissioner of labor of that state. This report contains many points of interest. It shows among other things, that the operator's duties are arduous and her salary exceedingly small. The average salary paid telephone operators in Texas was found to be $22.80 per month. Operators are often required to work in poorly ventilated and unsanitary rooms. Commissioner Myers' statement is in part as follows:

"If the average user of the telephone would investigate the trying and nerve-racking duties of the frail girl operators in the larger exchanges they would be more patient with them when using the telephone. Considering the strain and stress of their task they do remarkably well and should not be upbraided in the manner so commonly resorted to. They sit at the switchboard an average of nine hours per day, with receivers as ear muffs, watching an average of 170 signals, and serving perhaps 185 subscribers, since two or more subscribers may use one line. The estimated number of calls per hour that an operator may efficiently handle varies from 230 to 275, and during a busy time they have been known to handle as many as 450 calls in an hour.

"The rooms in which operators have to work are in many cases poorly ventilated and the little breeze they get comes from electric fans. In some of the operating rooms artificial lights are necessary, especially on dark days.

"Based on the reports from 105 telephone exchanges located in eighty-two different counties the average earnings for 1909 of 1,475 operators were $273.65 each, or an average of only $22.80 per month. D.

Texas Independent Telephone Association.

The Third District Independent Telephone Association of Texas held its annual meeting in San Marcos, Tex., September 17, and was well attended by representatives from the various companies in the district, which includes about fifty exchanges and covers one-third of the state. Various subjects concerning the interests of the independent telephone companies of the country and that district were discussed. The meeting of the State Association, to be held in Dallas, Tex., October 26 and 27, was called to the attention of the meeting and steps were taken to send a strong delegation from the third district. The meeting was held under the auspices of the San Marcos Telephone Company, of which D. H. Bruton is manager. State Secretary Leon Spencer, of Gainesville, acted as secretary, Mr. Bruton presiding. The following were present:

R. E. Carrington, Austin; R. S. Shelley, Austin; S. W. Menefee, Kansas City, Mo.; G. T. Howe, Buda; H. P. Kelley, Kyle; D. H. Bruton, San Marcos; D. C. Lingo, Dallas; J. M. Roberts, New Braunfels; C. I. Echols, Dallas; Leon Spencer, Gainesville; Merton Swift, San Marcos; G. G. Johnson, San Marcos; E. L. Larabee, Monarch Telephone Manufacturing Company; G. W. Donaldson, San Marcos. D.

Interstate Commission Control of Telephone and Telegraph Companies.

In commenting on the recently authorized control of interstate telephone and telegraph companies, a newspaper in Washington, D. C., says:

"According to the view of men in the Interstate Commerce Commission, who are familiar with the complexity of railroad rate making and railroad rate adjusting, Congress opened a Pandora's box when it put the telephone and telegraph companies under the Interstate Commerce law. So great is the task before the Commission that no attempt has yet been made at even the most formal beginning.

"Formal beginning would be requiring the companies to file tariffs showing the rates, and the blotting out of practically every telephone directory the line line which says: 'These rates subject to change without notice.' The rates are fixed and must remain as they are until a company desiring to increase its income convinces the Commission that the proposed higher toll is necessary.

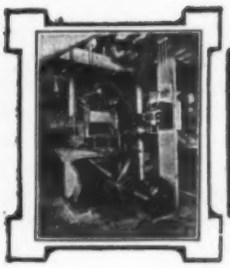
"The first question likely to come before the Commission is one of jurisdiction. Practically all the telephones in the country are part of an interstate system of lines. Every Bell telephone company advertises its service as local and long distance. If every one is a long-distance line, then, except in a few cases, it comes under the control of the Interstate Commerce Commission.

"The local and long-distance systems are so closely knit that the Commission, it is believed, will have to assume a very large measure of control over local exchanges, as to rates and practices, so as to amount almost to a control of all urban business by the Federal Government."

Duplicate Telephones.

In a recent issue the Baltimore *Evening Sun* discusses at some length the question of duplicate telephone systems and measured rates. After speaking of the opposition (anti-Bell) company and its first success wherein it attained a list of subscribers of between 8,000 and 9,000, at the present time, however, reduced to about 2,800, the *Sun* says:

Experts in telephone matters now say that the Maryland Company was founded upon an illogical basis and that the scheme of charging a flat rate for unlimited service upon which it was started was fallacious. George R. Webb, its guiding spirit for a number of years, says that had he known as much about the business before starting the Maryland Telephone Company as he learned during the time he directed its affairs he never would have been connected with it. At any rate the company never was a shining success. Some municipalities still cling to the idea that competition in the business is a good thing, but in some of the great cities, where it has been given a thorough trial it is said to have been a failure. Arguments against duplicate telephone services are based on the expensiveness of the proposition. Even though one company gives a flat rate, covering what is generally characterized as an unlimited service while the other bases its charges on a measured service, the case, it is said, is not altered. Here, for instance, where nearly every one who has a Maryland telephone also has a Chesapeake and Potomac, the Maryland Company charges $80 per year per telephone for its service, while the Chesapeake and Potomac regulates its charges by the number of messages used. Some who have studied the situation say that it is considerably cheaper to use only the last mentioned line and that the $80 paid to the Maryland Company will buy enough additional messages from the Chesapeake and Potomac to more than make up for what is gained by having unlimited use of the Maryland's lines.



Industrial Power

A MINING POWER PLANT.

THE HAMPTON POWER PLANT OF THE DELAWARE, LACKAWANNA & WESTERN RAILWAY COMPANY.

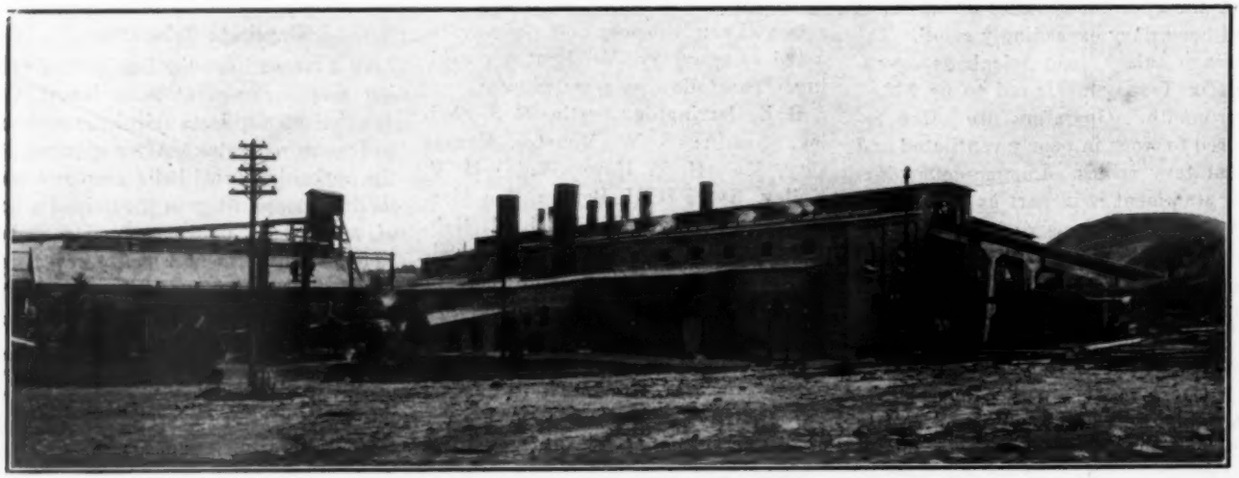
A reputation for thoroughness and excellence characterizes all the undertakings of the Delaware, Lackawanna & Western Railway Company, and nowhere is it better illustrated than in its Hampton power plant at Scranton, Pa. Originally, this was essentially a steam plant and supplied steam for both surface and underground operations. In 1904 extensive changes and additions were made in the power plant and in the operation of the mines, and the use of electric power introduced for many purposes. Electrical energy is now used to run electric locomotives, hoists, drills, pumps, lights, etc., at the Diamond, Brisbin, Hyde Park, Sloan and Hampton mines and this is all supplied from the central station at the Hampton mine by an extensive distribution system.

This location of the plant has several advantages. It is centrally located in reference to the five collieries and fifteen additional mines which are furnished steam or electricity from it. The coal supply is abundant and delivered most economically and the water is brought by gravity from the West hill section to a 750,000-gallon reservoir.

The coal used in the boilers is the size termed "barley." This comes from the washeries in ordinary railroad cars, from which it is dumped into a concrete pit of 100 tons capacity. From the pit the coal is discharged on to an endless conveyor belt, 750 feet long, which extends the length of the boiler room over the bunkers. An automatic tripper is used with this conveyor and about fifty tons can be handled per hour. This conveyor is operated by a thirty-horsepower direct-current motor.

The original boiler equipment consisted of fifteen 313-horsepower Babcock & Wilcox boilers set in a single row. These were equipped with McClave stokers. When the new power house was built, six two-drum, 625-horsepower Stirling hand-fired boilers were added. Blowers furnished by the American Blower Company and driven by steam engines supply both forced and induced draft. Completely encircling the boiler house over the top of the boilers is a twelve-inch steam header. The Babcock & Wilcox boilers are connected to this header by five-inch pipe bends, while eight-inch pipe bends are used for the Stirling boilers. A twelve-inch pipe line runs to the turbine room, and six-inch leads are taken from this to the Curtis turbines and eight-inch leads to the Allis-Chalmers turbines. Five steam lines lead from the boiler house to the various collieries. Four of these are eight inches in diameter and vary from 1,450 to 3,450 feet long, while the fifth is a twelve-inch line 1,200 feet long. The steam pressure carried on the boilers is 145 pounds.

An interesting feature of the boiler house is the disposal made of the ashes. From the ashpits they fall into a tunnel which extends underneath and which has a grade of three-eighths of an inch to the foot. Water pumped from one of the mines is turned into this tunnel and used to flush the ashes into a bore hole leading to another part of the mine, which has been abandoned. It is estimated that about fifty tons of ashes are thus disposed of each day and, in course of time, will fill up the old chambers and afford sufficient support to the roof so that the supporting coal columns can be removed.



HAMPTON POWER PLANT, DELAWARE, LACKAWANNA & WESTERN RAILWAY COMPANY.

The generating station is a one-story brick building, which was 50 by 30 feet when the first power installation was made, but which has been enlarged to accommodate the additional units, as mentioned later. The foundations are of concrete, as are those for the turbines. The floor is of reinforced concrete and the entire building may be considered fireproof, with the possible exception of the roof, which has some wood in its construction.

The original equipment of the generator plant included three 500-kilowatt, sixty-cycle, three-phase, 2,300-volt vertical Curtis turbines. (Two more were added soon after this first installation.) Two fifty-kilowatt engine-driven units furnished excitation current. Elevated jet condensers outside the building maintained the vacuum.

The success that was met with in the use of electricity in mine operation following this first installation led the company to plan for much more extended application. For generating purposes it was decided to use turbines of larger capacity and of the horizontal type. The larger size would give increased economy of operation and would occupy less floor space per kilowatt. The horizontal type was selected because of the much simpler construction and ease of repair.

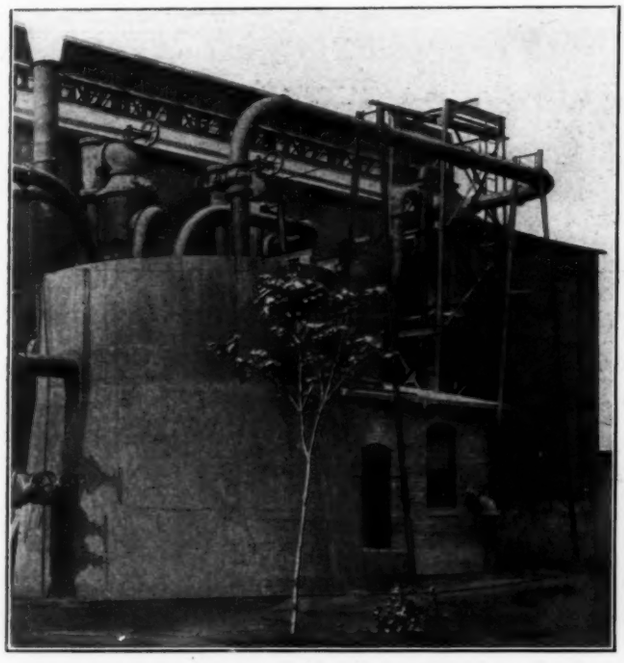
In 1908 the power house was enlarged and a 2,000-kilowatt Allis-Chalmers turbine was installed. In 1909 a duplicate of this was put in operation. These turbines make 1,800 revolutions per minute and deliver three-phase, sixty-cycle current at 2,300 volts. The turbines are of the standard condensing type and are supplied with the regular auxiliary oil relay control for load regulation and an overspeed safety stop. They have a large overload capacity. The generators are of the standard turbo type and are provided with large air spaces and fans for cooling purposes so that they are enabled to carry heavy overloads for long periods. These two turbines now carry practically the entire load, the Curtis turbines being used mainly as a reserve.

Just outside the building an Allis-Chalmers barometric condenser is erected for each turbine. The water used for condensing purposes is the regular mine water, as it has a low temperature. Unfortunately, however, this, like most water coming from mines, is highly impregnated with sulphurous acid. An analysis showed thirty-nine grains per gallon of water. The condensers, as first installed, were of ordinary cast-iron construction, and it was found that these deteriorated rapidly under the action of the acid-laden water. To prevent this eating of the iron the head and pipes were fitted with a wooden lining. While this does not prevent the water getting to the pipe it does prevent a direct washing action on its surface with the constant contact of fresh, active water at all times.

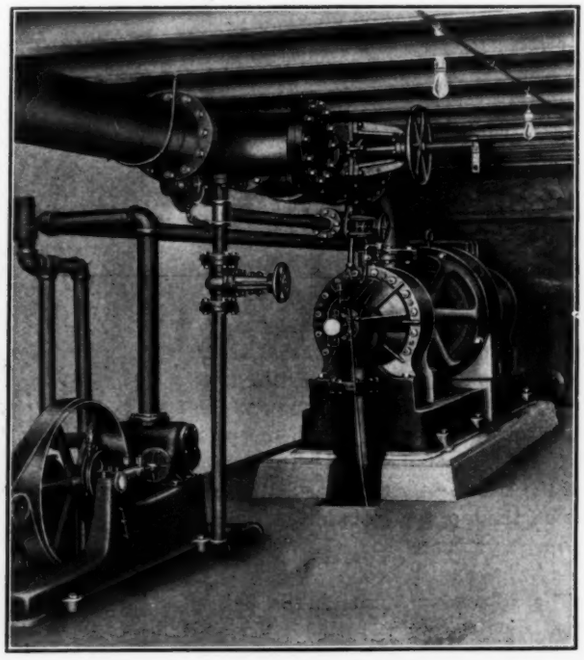
In addition to the engine-driven exciter sets already mentioned, a fifty-kilowatt motor-generator set was installed when the new turbines were put in operation. This consists of a 125-volt, 400-ampere generator direct-connected to a 2,300-volt, three-phase, sixty-cycle, eighty-five-horsepower induction motor.

The switchboard consists of sixteen panels of blue Vermont marble. Seven of these are generator panels and the remainder are instrument and distribution panels. The arrangement of the wires at the back of the board is extremely compact. All wires and cables connecting the machines and switchboard are carried in conduits in the concrete floor. The feed lines leaving the switchboard are incased in fiber conduit until they reach the lightning arresters. These are supported from the wall of the station, and between each pair of arresters is a concrete slab. These slabs rest on a platform above and behind the switchboard.

Energy is distributed from the power house over 2,300-volt three-phase lines to substations at each of the mines, to the railroad shops and to the passen-



BAROMETRIC CONDENSERS AND SUPPLY TANK.



MOTOR-DRIVEN PUMP.

ger station. A tie line also connects with the station of the Scranton Electric Light Company, so that either plant can serve the other in case of necessity.

The substations at all the mines are practically identical and a description of one will suffice. The Sloan substation is seventeen feet six inches square and is practically fireproof. This station contains a 200-kilowatt rotary converter and three seventy-five-kilowatt step-down transformers, besides a two-panel switchboard. By means of the transformers and converter the 2,300-volt alternating current is changed to 275-volt direct current for use in mine operation. The power lines taken into the mines sometimes consist of rubber-covered wire supported on glass insulators fastened to the buntons, when the shaft is dry and no trouble from falling ice would occur. Usually lead-covered cables placed in an iron pipe are used. To support the cable under this construction the cable is wrapped one or more times about a rod fastened to the buntons above the pipe. Precautions in the matter of insulation are, of course, taken. The end of the pipe is closed around the cable by means of wood bushings soaked in paraffin and shellaced. With long cables use is made of a clamp at the point where the cable leaves the pipe at the bottom of the shaft. By clamping the two tightly together and slacking off the top, the cable kinks slightly and gives a surface friction which assists in holding it.

The apparatus served in the mines by these substations includes 6.5 and thirteen-ton electric locomotives, electric mine hoists, water hoists, centrifugal pumps and ventilating fans. The electric locomotives have very largely replaced mule haulage in the mines and have assisted in materially increasing the output. Electric drills have been introduced also with considerable success.

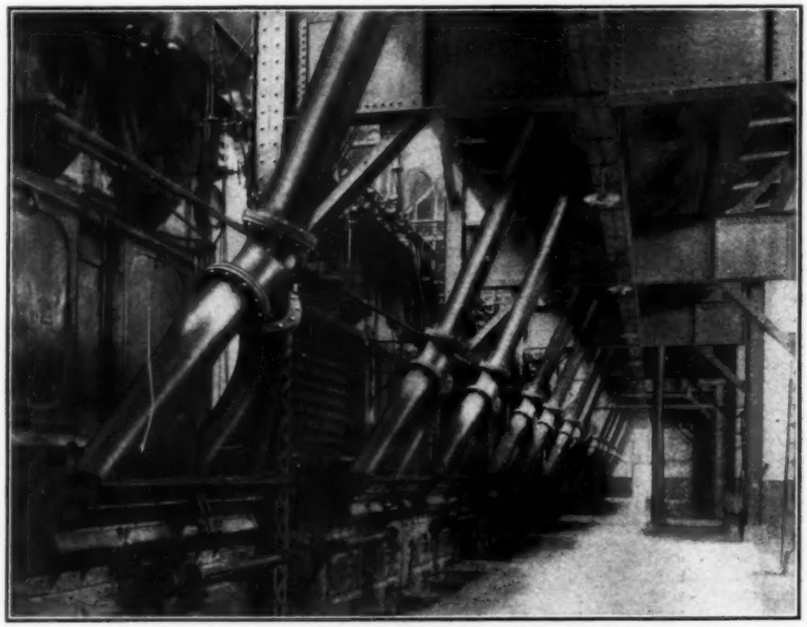
The water hoist mentioned is very similar to a shaft hoist, except that buckets are used instead of cages. The bucket holds seventeen tons, or approximately 4,000 gallons, of water, and each equipment will hoist a bucket every sixty-two seconds. An 800-horsepower induction motor operates the apparatus through friction clutch, gears, etc. The operation of this hoist was entirely successful, but its first cost was so great that use is now also made of a motor-driven centrifugal mine pump for removing the water.

This unit was furnished by the Allis-Chalmers Company and comprised a sixteen-inch six-stage centrifugal pump directly connected to a 1,000-horsepower, 2,300-volt, three-phase, sixty-cycle induction motor, running at 705 revolutions per minute. The pump has a capacity of 5,000 gallons of water per minute against a head of 500 feet. Due to the fact that the water to be handled contains so much sulphurous acid, it was necessary to build of bronze all parts that come in contact with the water. This pump has but recently been installed.

Beside the power used in the mines, current is supplied to the repair shops for operating direct-current motors. The freight yards are lighted by 100 arc lamps and the passenger station, freight office, etc., by 1,500 incandescent lamps.

One of the points that impresses the visitor to this plant is the remarkable care that is taken at all points to maintain all parts of the power system at the highest efficiency. It is ordinarily supposed that at a coal mine little attention is paid to the amount of coal used in operation, but here strict economy is observed and the boiler room inspector is very watchful of the firing. The power house and all substations are kept particularly clean and in better shape than many commercial central stations.

H. M. Warren, electrical engineer of the Delaware, Lackawanna & Western Railway, designed the power plant, and it was built under his direction. To him is due the credit for the present successful operation of the plant.



INTERIOR OF BOILER HOUSE, HAMPTON PLANT.

Electricity and Plant Growth.

At a recent lecture in Great Britain, J. H. Priestly, lecturer in botany at the University of Bristol, described some experiments in which remarkable success was obtained in stimulating the growth of twenty acres of wheat by electricity. A low-tension current, generated by a small isolated plant, was transmitted direct to the field and there transformed in an outhouse provided for this purpose with a special form of induction coil devised by Sir Oliver Lodge, the well-known British physicist. The high-tension current was transmitted to a barbed-wire arrangement distributed among the growing plants, the barbs serving as discharge points for the current. The increase in growth of the wheat was estimated at twenty-nine per cent. Almost as good results were obtained in the growing of mangold wurzels, cucumbers, and strawberries. An appreciable increase of nitrates in the soil was noted, due to the electrical treatment. The best results are obtainable on days when the sun is not shining.

INDUCTION MOTORS.—(1) Why is it that a four-pole, sixteen-inch, sixty-cycle fan motor does not run at 1,800 revolutions per minute with the fan blades off? With the blades on the motor runs from 1,300 to 1,500 revolutions per minute; with the blades off it runs from 1,650 to 1,700. (2) How are the apparent watts measured on a two-phase induction motor?—L. M., Chicago.

(1) Although 1,800 is the synchronous speed of a four-pole, sixty-cycle induction motor, it will be found that it cannot be made to run at this speed, even on no load. In any induction motor there is always a certain amount of slip or decrease from synchronous speed, which slip increases with the load. The slip should not be as great as indicated by the no-load speeds given; possible reasons for this excess no-load slip are: bearings in poor condition, so that there was considerable load on the motor due to friction; frequency of the circuit slightly less than sixty cycles; inaccuracy of the speed-counting instrument. (2) The best way to measure the apparent watts in this case is to place an ammeter in one of the wires of each phase and a voltmeter across each phase and take all four readings at the same instant. The sum of the products of the voltmeter and ammeter readings of the two phases is the total apparent power of the circuit. If it is a three-wire, two-phase system, one ammeter placed in the common return wire suffices. Its reading must be multiplied separately by the readings of two voltmeters connected across each phase and the two products added. If only one voltmeter is available and the load balance is constant, the voltmeter may be connected first across one phase and then across the other. As the load balance is apt to change, the use of two instruments is recommended.

RESISTANCE FOR SLIP-RING MOTOR.—How can I find the resistance of a three-phase, sixty-cycle, 220-volt, five-horsepower, slip-ring motor when the makers send me the following data for this motor: 102 volts between rings; 25 amperes per ring? I will use a Y-connected controller for the rheostat.—A. S., Chicago.

With 102 volts between slip rings and a Y-connected rheostat, there will be impressed on each of the three branches of the rheostat $102 \div \sqrt{3} = 58.8$ volts. To keep the current down to 25 amperes there must be provided $58.8 \div 25 = 2.31$ ohms in each branch of the rheostat. Care must be taken to use such material for the resistance as is capable of carrying 25 amperes without excessive heating.

INTERRUPTED LIGHTING OF THIRD-RAIL CARS.—While riding on the interurban railway in the evening I have frequently noticed an annoying interruption of the lights that I am told is caused by breaks in the third rail at street and highway crossings. Would it not be feasible to have storage batteries on the cars to supply the lights while crossing roads? Is not an accident liable to happen in case a car stopped on a crossing?—B. S., Wheaton, Ill.

The interrupted lighting is due to the cause stated. It is not possible to carry the third rail unbroken across a public street, highway or railway crossing. While it would be feasible to provide storage batteries on the cars for this momentary lighting, it would not be advisable to do so, because it would require expensive complications in the lighting equipment not justified by the slight advantage obtained. Since the voltage of the car circuit is over 500, it would require some 250 cells per car and a throw-over switching arrangement to put the lights only on the battery when approaching the crossing and back on the main circuit after leaving the crossing. It seems an excessive burden to provide a battery for only about a minute's total use on a trip. If the lights were to be left on the battery continuously, the latter would have to be of considerable capacity and the equipment of 250 cells would be very bulky. There is practically no danger of a car stopping on a crossing, because the motormen know they must avoid this and always approach the crossing with sufficient momentum to get over safely. If it were imperative to supply current to the car even while crossing a road or street, it could be done by providing a stretch of overhead conductor across the road and a bow collector on top of the car. An arrangement of this kind is used by the South Side Elevated Railroad of Chicago to obviate the use of the third rail in the storage yards. Even such an arrangement is unnecessary if the road runs trains of two or more electrically interconnected cars each equipped with contact shoes. The front shoe will then make contact on the rail on the far side of the crossing before the last shoe leaves the rail on the near side.

ALUMINUM VALVE FOR SPARK COIL.—We have a twenty-two-inch spark coil which is operated on direct current by a mercury interrupter. I should like to know the correct solution to use for an aluminum valve (what salt of phosphorus and what strength of solution), also what size and how many plates to use on a sixty-cycle, 115-volt, alternating current so as to get about 1.5 kilowatts.—L. H. B., St. Louis, Mo.

Many solutions have been used for aluminum cells, principally phosphates, borates and carbonates of alkaline metals. Probably best is a saturated solution of ammonium borate, either $NH_4HB_2O_4$ or $(NH_4)_2B_2O_4$. A one-per-cent-solution of ammonium phosphate, $(NH_4)_2HPO_4$ is also said to give fairly good results. A single aluminum plate serves as one electrode on each side of which is a carbon plate serving as the other electrode. The area of the plate should be at least ten square inches on each side; this gives for the thirteen amperes to be used a current density of one-tenth-ampere per square centimeter. Purity of the electrolyte solution is essential, also low temperature. If these precautions are not observed the plate will become pitted. To keep the temperature low in continuous service the aluminum cell should be surrounded by a cooling bath; if this is running water a grounding of the supply circuit must be guarded against.

New Electrical and Mechanical Apparatus and Appliances.

THE AMERICAN GAS ENGINE.

A REVIEW OF GAS-ENGINE PRACTICE, WITH PARTICULAR REFERENCE TO THE PRODUCTS OF THE ALLIS-CHALMERS CO.

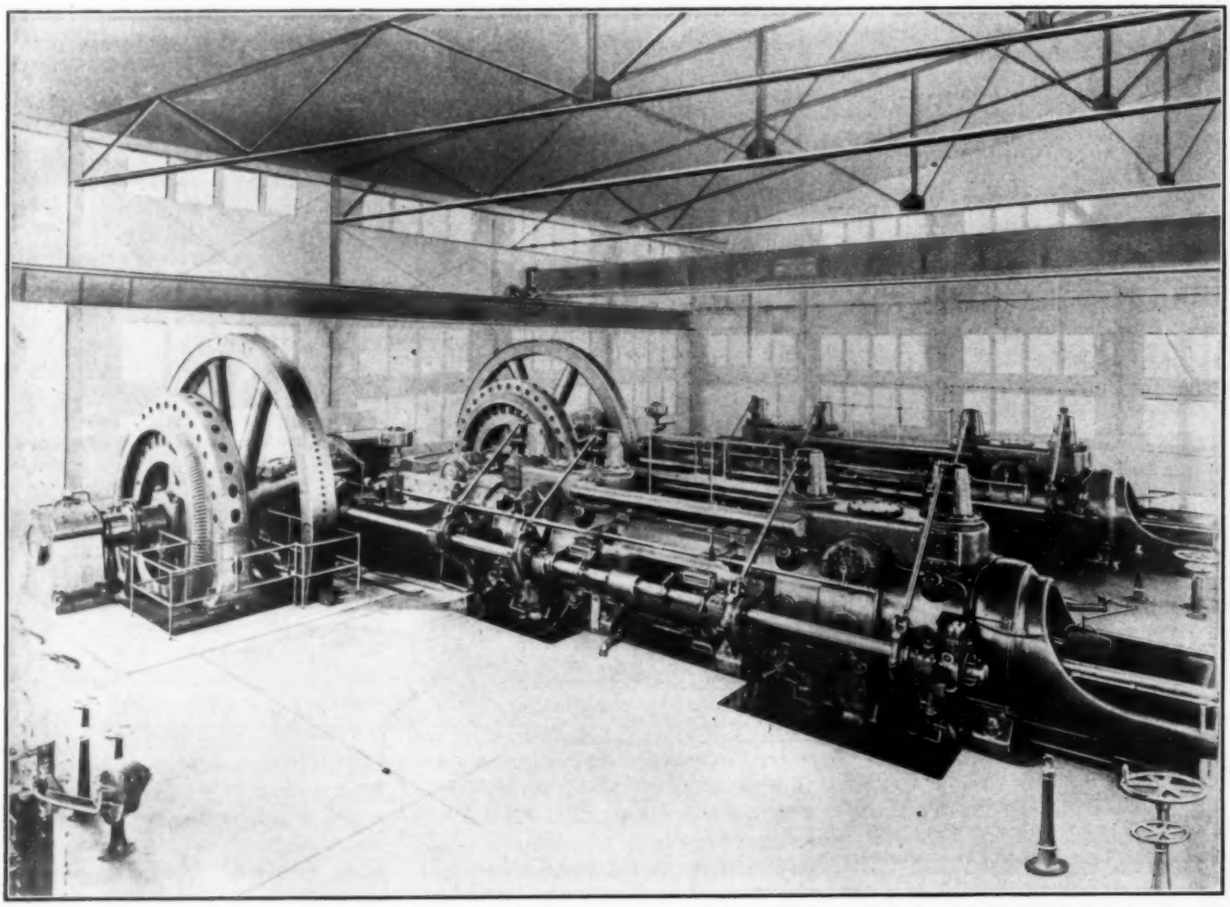
During the past six years the United States has witnessed a most important achievement in the industrial world in the development of gas engines for large power stations. Within three years this type of engine has reached a position of equality with the steam-driven units in reliability for continuous service under the most severe conditions.

Progress in the design of the gas engine has been largely due to natural conditions existing in the steel industry which presented an ideal field for its use and, until recently, practically all large gas-engine installations in this country were in steel mills. Here the conditions demanded an engine which was reliable for continuous service, which would operate on gas of low heat value, and capable of handling large overloads.

The engine developed by the Allis-Chalmers Company is distinctly American in type, is horizontal and double-acting, and utilizes the four-stroke cycle, with cylinders arranged in tandem. This arrangement of cylinders in the two-cylinder tandem engine gives the same continuous application of power to the crankshaft that is obtained with a simple steam engine.

Engines are also designed with twin tandem cylinders, there being four gas cylinders, two tandem sets, placed side by side and connected to cranks on the ends of a common shaft. The double-crank arrangement, or twin-tandem engine, gives four power strokes per revolution, with cranks set at right angles, similar to the cross-compound steam engine. Either cylinder arrangement with proper-sized flywheels easily gives a turning movement sufficiently uniform for all electrical work. One installation has seventeen gas engines in the same power house working in parallel.

It is in the frame that the principal difference between European and American design is apparent. Foreign practice favors the use of the center crank. This necessitates three bearings for the crankshaft of a single-crank engine and four bearings for a twin engine. The Allis-Chalmers engine is designed with a side crank which requires but two bearings for the crankshaft of either single or twin engine. The stresses transmitted through the frame in the side-crank gas engine are no greater than this company has successfully provided for in its steam engines.



GAS-ENGINE-DRIVEN GENERATORS IN THE POWER HOUSE OF THE SOUTHWESTERN STATES PORTLAND CEMENT COMPANY.

Another essential feature of this gas engine is an intermediate crosshead between the two gas cylinders, and tail crosshead at the rear of the second gas cylinder, each supported by an oiled slide resting on the foundations and designed to support the weight of the pistons and piston rods, so that these may travel without touching either the bore of the gas cylinders or of the stuffing boxes. The inlet valves are located at the top and the outlet valves at the bottom of the gas cylinder, which arrangement is absolutely essential to the proper scavenging of the cylinder. The provision for removing the cylinder heads without disconnecting the cylinders from the frame or tie piece is of great value in facilitating proper inspection of pistons and cylinder bores.

The point of greatest stress in a gas engine is in the frame and in this machine the weight of the frame is about one-fourth of the total weight. It is cast in one piece for all sizes of engines and is formed so as to include the slide for the main crosshead, the jaw for the main bearing and a double flange at the end, to which the forward cylinder is bolted. The frame is of the open-top construction which permits the easy removal of the front cylinder head, piston and piston rod. The jaw in which the main-bearing shells are held and which is subjected to the greatest stresses is made particularly heavy and rigid. It is further strengthened by two steel tie-bolts extending across the jaw above the shaft. These eliminate all bending stresses in the frame at this point but do not interfere with the removal of the main-bearing cap.

The gas cylinders are cast in one piece as this has been demonstrated to give the best operating results. The cylinder casting proper is subjected to no wear whatever as the working bore is fitted with a hard cast-iron liner to take the wear due to the piston rings. This makes possible the use of a tough fibrous iron for the cylinder which is adapted to meet the strains induced. The liner for the working bore is made of a special grade of very hard, fine-grained iron, which has good wearing qualities. A tongue-and-groove fit at the middle of its length, reinforced by a shrink fit over its entire surface, holds the liner in position. After the liner is in place, the finishing cut is made.

The valve gear on this engine is one of the most notable features as it is simple and strong with a positive motion. Necessary adjustments are few and easily made. The wearing surfaces are large, which insures noiseless operation, durability and efficiency. By a few simple alterations the gear can be changed from a condition suitable for one character of gas to that for a gas of greatly different quality. Both the inlet and exhaust valves are of the single-beat poppet type and are provided for each end of each cylinder so that any valve can be independently adjusted. The complete valves are mounted in cast-iron valve chambers which are bolted to the cylinder as a unit and which can easily be removed for inspection or replacement.

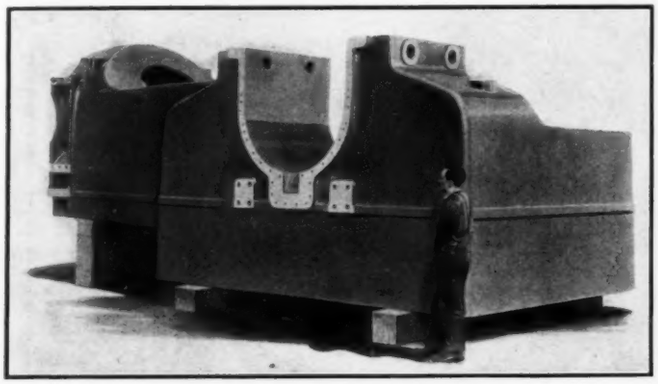
A sensitive and quick-acting safety stop device, consisting of a centrifugal trip set into a disk keyed to the layshaft, opens a switch in the ignition circuit and cuts off the current in the event of the engine speeding beyond the limit of safety.

The pistons are cast in one piece. Each piston is fitted with a number of cast-iron spring packing rings. It is accurately centered on a piston rod of selected high-carbon steel. The two pistons and corresponding rods are exact duplicates and the rods are rigidly coupled together in the intermediate crosshead, so as to form the equivalent of one continuous rod. This coupling is easily disconnected and the removal of either piston and rod from the cylinder is greatly facilitated by this construction.

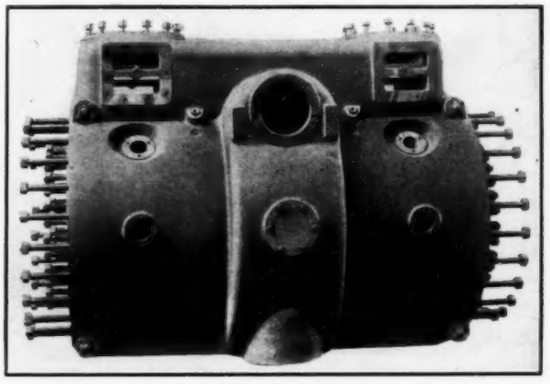
All large gas engines require compressed air to start them in motion and inaugurate the cycle of suction and compression strokes preparatory to the first explosion stroke. To insure prompt reliable starting, a pressure of about 200 pounds per square inch should be used. It is customary to have a storage tank in the engine house of sufficient capacity to make two or three starts without recharging. A small air compressor operated either by an electric motor or a gasoline engine is a very convenient apparatus for charging this storage tank.

The regular valve gear of the gas engine cannot be used to admit and release air pressure in a proper cycle to accomplish the starting and the engine is provided with a special air starting-gear which is normally disengaged and inoperative. On opening the air throttle-valve the air pressure automatically throws the valve gear into engagement with cams on the layshaft, causing the cams to open and close the air valves in proper timing to effect the starting of the engine.

The special mechanical features heretofore described for insuring continuous operation of the gas engine would be of little avail without an efficient and reliable lubricating system. The Allis-Chalmers gas engines are thoroughly



JAW END OF GAS-ENGINE FRAME.



SIDE VIEW OF GAS-ENGINE CYLINDER.

equipped with substantial, efficient and neat oiling devices for all bearings and slides requiring a continuous and reliable supply of lubricating oil. The crankshaft bearings, crosshead slides, crankpin, and crosshead pin are each equipped with separate oil supply, with visible feed and regulating valve. For the above named bearings and slides a continuous gravity-oiling system is the most efficient, reliable and economical oiling arrangement that can be provided. Each engine is equipped with a small plunger pump operated from the layshaft. This is used for pumping a supply of oil to an elevated tank for oil storage. The pump has a capacity in excess of the greatest demands for oil, so that the storage tank will always be filled. The excess oil handled by the pump overflows from the storage tank back into the pump suction. The engine is equipped with substantial and tight oil-guards, so that there is no waste of oil from the moving parts of the running gear, due to centrifugal action. Proper precautions have been taken to prevent cooling water from mixing with the oil overflowing from the bearings. All gears are entirely closed and run in an oil bath.

The cylinders are lubricated by mechanically operated sight-feed oil-pumps driven from the layshaft. A separate pump is provided for each gas cylinder and each pump has independent plungers and sight feeds for pumping the oil to each end of the cylinder bore, each piston-rod packing-case, and each exhaust-valve stem.

The Allis-Chalmers Company has at this time in operation or in process of erection over 380,000 horsepower of this type of engine, covering practically every class of manufacturing plants and power stations.

Many of its installations have been for complete plants including auxiliaries of a type suitable for the local conditions.

There is much and increasing dissatisfaction in leading commercial circles in Germany, says London *Engineering*, at the Imperial Postal Department having again cold-shouldered the oft-repeated wish for the establishment of telephonic connection between Berlin and other important German centers and London, on the plea that a long-distance line would suffer too much disturbance in consequence of the combination of aerial lines and submarine cables.

Engineering Department Visits Shelby.

On Saturday, September 17, about thirty technical men from the Engineering Department of the National Electric Lamp Association spent a most enjoyable day in Shelby, Ohio, at the invitation of the Shelby Electric Company. The party arrived at Shelby Junction at 10:30 a. m. in good spirits and ready for anything.

The "first order of business" was seeing the factory, and the engineers were conducted through the works in two parties. The completeness of the lamp-making facilities, the orderliness and system of the arrangements and the many conveniences for employes made a decidedly favorable impression.

After seeing the factory the party was taken to the Colonial Club, where reading matter, billiard tables and general good-fellowship were in evidence.

After dinner the Shelby employes "took the visitors into camp" in a highly exciting baseball match, winning by the score of 3 to 0. The Engineering Department, however, captured the tennis honors, winning two matches of doubles and one of singles.

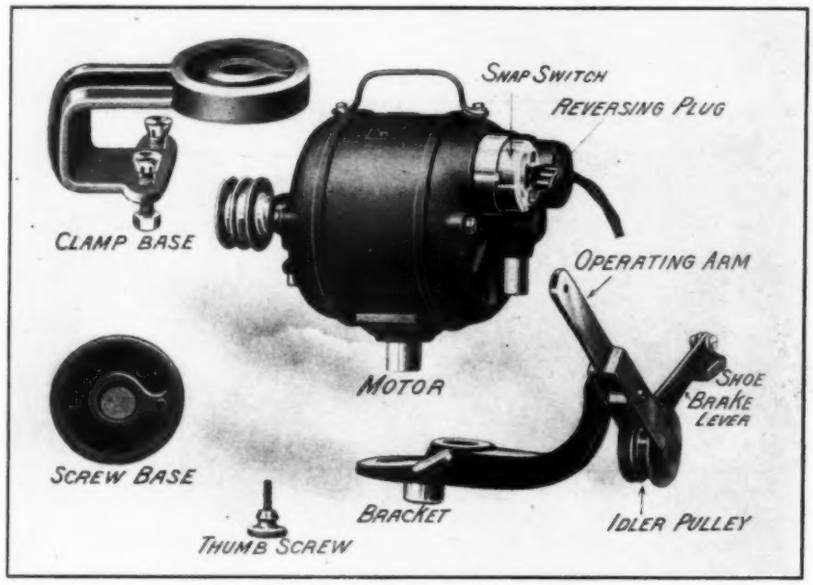
An evening spread at the Sherman Hotel and a dance at "The Plum Tree" wound up the day's festivities.

Before returning to Cleveland the visiting party unanimously voted that W. W. Van Horn, A. W. Freund and R. W. Caswell, of the Shelby Electric Company, were peerless hosts, whatever they may know about the lamp business.

Westinghouse General Utility Motor.

The general utility motor now being placed upon the market by the Westinghouse Electric & Manufacturing Company marks the latest advance in the application of electric motors to household convenience. By means of its special attachments the motor can be adapted to a variety of uses about the house. The new motor commends itself heartily to the favor of central-station companies as it provides another wedge for the introduction of electricity into the home. Furthermore, it is essentially a day load. The motor takes from forty to 120 watts for its operation.

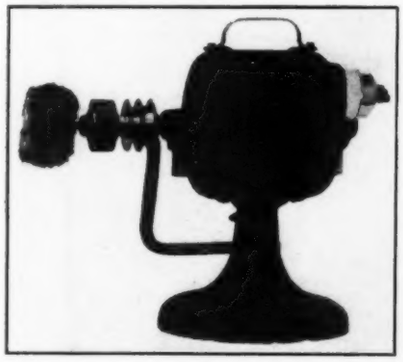
The general utility motor can be readily arranged to operate the following devices: Family sewing machine, buffing, polishing and grinding wheels, ventilating blower, jewel lathe, light machinery, small lathes, sign flasher, moving window display, mechanical toys, etc. The motor is sold complete with one or more attachments. Further attachments can be obtained by the purchaser as desired. A different attachment is not necessary for every one of the uses mentioned above, as some of the attachments make the motor available for several purposes without change. The general utility ventilating outfit shown in one of the accompanying illustrations is one of the features of the new apparatus. The small blower will supply fresh air to the kitchen, increase the draft of a furnace, remove foul air



WESTINGHOUSE GENERAL UTILITY MOTOR.

from sick rooms, and readily adapt itself to any small ventilating work. By fitting the blower openings with suitable pipe, air currents can be directed wherever desired.

The general utility motors are made for operation on 115 and 230-volt direct-current circuits, and on 110 and 220-volt alternating circuits of sixty and 133 cycles. The direct-current motors are shunt wound while the alternating-current motors are of the induction type, single phase. The motors run at a speed of 1,700 revolutions per minute. The motor is light and can be easily carried from place to place by means of a handle in the top of the frame. It is artistically finished in black enamel to harmonize with the other house decorations. The applications of the attachments are positive and it is impossible to put them on wrong.



MOTOR WITH BUFFING ATTACHMENT.

MOTOR DRIVING BLOWER.

Boosting Electric Vehicles.

The large combination advertising campaign originated by the Electric Storage Battery Company for the benefit of the central-station electric-vehicle industry has developed so successfully that it has now been deemed advisable to place its further development in the hands of the newly formed Electric Vehicle Association of America.

The Battery Company, as mentioned in a previous issue of this paper, has successfully worked up the details and secured the hearty co-operation of electric-vehicle manufacturers and central-station managers.

The large publicity given to the electric vehicle by this combination scheme will unquestionably result in a great increase in sales of electric vehicles, which means a permanent source of revenue for central-station companies.

Louisville & Nashville Installs Additional Telephone Train-dispatching Equipment.

The Louisville & Nashville Railroad has just placed an order for a complete equipment of Western Electric telephone train-dispatching apparatus, including selectors and telephones. This equipment will cover the Cumberland Valley and Kentucky divisions from Cincinnati to Norton, a distance of 304 miles, and will consist of six circuits in all, four train wires and two message circuits, with a total of 162 stations.

One circuit will extend from Cincinnati, Ohio, to Paris, Ky., with a branch to Maysville. This circuit covers 136 miles and will be equipped for thirty-two way stations. The train dispatcher will be located at Paris.

Another circuit extends from Paris to Corbin, with a branch from Paris to Lexington, and another from Rushmore Junction to Rowland. The mileage covered by this circuit is 165 and thirty way stations will be equipped. The dispatcher for this circuit will also be located at Paris.

In addition, there is a message wire circuit, used to handle general railway business, extending from Paris to Cincinnati and from Cincinnati to Corbin, the dispatcher being located at Paris. This circuit is 195 miles in length and has forty-nine way stations.

The Corbin to Norton division consists of three circuits, the first a train-dispatching circuit extending from Corbin to Middleborough, the second a train-dispatching circuit from Middleborough to Norton, and the third a message wire circuit from Corbin through to Norton. The circuit from Corbin to Middleborough is forty-one miles in length and has fourteen way stations, while the Middleborough to Norton division, seventy-nine miles in length, is equipped with fourteen stations. The train dispatchers for both of these circuits, as well as the dispatcher for the message wire circuit, are located at Middleborough. The message wire circuit is used to handle general railway business and is 120 miles in length and consists of thirty-three stations.

The Louisville & Nashville already has installed a Western Electric train-dispatching telephone equipment, consisting of dispatcher's equipment and twenty-six way station selectors, between New Orleans and Mobile, a distance of 139.7 miles.

Telephone Equipment at Raleigh, N. C.

The Kellogg Switchboard & Supply Company, Chicago, Ill., announces that it has closed a contract for complete switchboard equipment for the Raleigh Telephone Company, of Raleigh, N. C. There is to be a new standard-type switchboard, consisting of two sections, each having a capacity for 3,000 multiple jacks. The two sections are equipped with 700 common-battery lines installed in five regular positions, with full multiple installed every four panels and twenty magneto lines installed next to the box panel.

Each of the regular positions is equipped with fifteen common-battery cord circuits, each pair of cords having an individual four-party ringing key. The farmer's position is equipped with ten combination toll-to-toll and toll-to-local cord circuits.

The Kellogg Company also furnishes the necessary main distributing frame and relay work. The Telephone Company will use the present power equipment.

This switchboard has some patented operating features in it which were furnished at the special request of the manager, W. A. Wynne. The system is so wired that when any subscriber removes his receiver from the hook, he will be immediately connected with the operator, who will receive the request for the subscriber desired and plug in with the calling cord and ring the desired party before inserting the answering plug, thus giving quicker service. If however, another call should come in before she completes the first call, the operator can prevent the second calling party from interfering by plugging into the answering jack with the answering cord.

New Locomotive for the Transit Development Company.

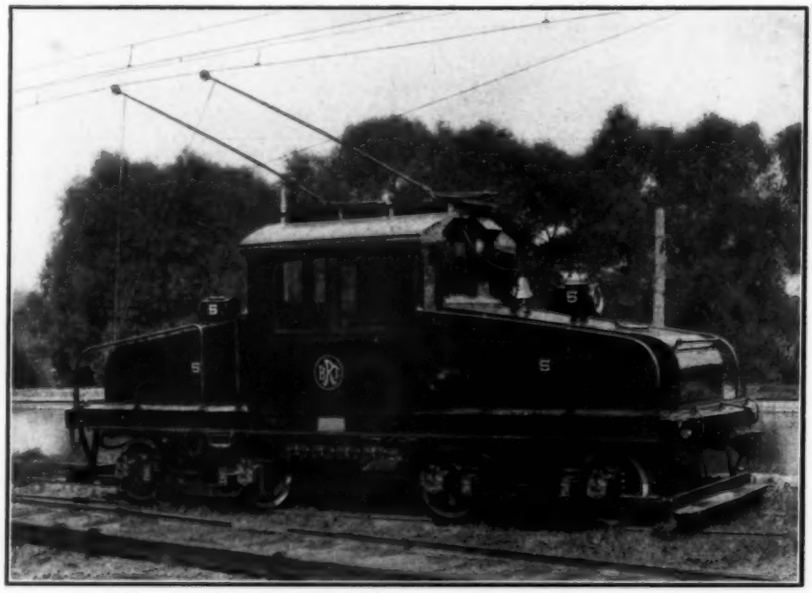
The locomotive for the Transit Development Company, illustrated and described in the following article, was designed for use in switching and freight service over the Brooklyn Rapid Transit lines and was built by the General Electric Company and the American Locomotive Company jointly.

The rapidly increasing demand for freight service over the Brooklyn lines and the peculiarities of this service have demanded a locomotive having several special features. The collection of heavy freight from railway terminals and docks, and the occasional short, sharp grades encountered, particularly along the water front, have necessitated a heavy type of locomotive, while the distribution of freight to shops and factories as far distant as South Brooklyn and Coney Island, and the requirement that such service shall not interfere with passenger service, made it imperative that the locomotive should be capable of operating at high speed.

The locomotive platform is built up of longitudinal sills of ten-inch channels extending the whole length and is fitted with cast-iron end frames and heavy built-up bolsters. Drawhead castings are attached to the center sills and end frames, thus giving them great rigidity. The locomotive has been designed for a weight of fifty-five tons, and the ballast required to bring it up to this weight consists of 10 by 2-inch bars running the whole length of the platform, notched over the bolster plates, and bolted to the longitudinal sills.

The locomotive cab consists of a main operating cab in the center of the platform, with auxiliary end cabs and side platform extending out toward the ends of the locomotive. This type of cab gives an extended view to the operator in all directions from his operating seat. The auxiliary cab contains sand boxes, air reservoirs, rheostats and contactors; while the main cab contains the controllers, brake valves, switches and other apparatus for the direct control of the locomotive.

Turning now to the electrical equipment of the locomotive there are several features of interest. The locomotive is furnished with high-power motors, the motor equipment consisting of four commutating-pole motors with a rating on the standard one-hour basis of 225 horsepower. Commutating-pole motors have demonstrated their satisfactory operation under severe fluctuation of load and voltage, and motors of this type and capacity are needed in the present case in order to meet the requirements presented by heavy tractive effort under starting conditions and high speeds upon the level. The locomotive is capable of exerting a tractive effort of 16,880 pounds at twenty miles per hour at the one-hour rating of the motors, or of maintaining a tractive effort of 6,000 pounds at a speed of thirty miles per hour. Stated in other words, it is capable of operating a 500-ton trailing train on the two-per-cent grades or of pulling the same train at a maximum speed of thirty miles per hour on the level.



BROOKLYN FREIGHT AND SWITCHING LOCOMOTIVE.

A distinctive feature of the locomotive is the type of control. Sprague General Electric Type-M control has been furnished, which provides three combinations of motors with a total of eighteen steps; seven steps with all four motors in series, six steps with motors in series-parallel, and five steps with all motors in parallel. Such a three-speed control is demanded by the conditions of service, because a high speed is required for level running with through freight and an economical slow speed for heavy switching work. Three-speed control has been used previously on locomotives for heavy railway service, but until lately such a control has not been required upon electric roads, and is a recent development made by the General Electric Company. The type of control required for electric locomotive service differs from that for ordinary car service in that it must be arranged to work the motors as close as possible to the slipping point of the wheels throughout the entire range of acceleration without sudden fluctuations of tractive effort. As an illustration of the range of the control it may be noted that the locomotive will develop a tractive effort of about 6,500 pounds on the first step of the controller with a current from the trolley of 150 amperes. On the series steps it will develop 27,500 pounds with 450 amperes, and will attain a maximum speed of about seven miles per hour with a 500-ton train. On the parallel steps the motors will require about four times these currents to develop the same tractive effort at a maximum speed of thirty miles per hour.

Controllers are placed at the engineer's operating seats at diagonally opposite corners of the main cab, and contactors are mounted in the auxiliary cabs, where they are convenient for inspection and repair. Third-rail shoes and trolley poles are arranged to collect current either from a third rail or from overhead trolley, as demanded by the equipment of the various Brooklyn elevated and surface lines.

Current Electrical News

GREAT BRITAIN.

(Special Correspondence.)

LONDON, SEPTEMBER 17.—An arbitration is now proceeding in London to determine whether the Dolter surface-contact system shall be taken out at Torquay and the overhead system substituted. The history of the Dolter system in Great Britain has been a by no means happy one. It has only been put down in three towns, and in one of them (Mexboro) it has already been replaced by the trolley system. In Torquay the company working the system desires to replace it, and at Hastings, where it is in use on two miles of line along the sea front, the operating company finds it is costing about one cent per car mile more than the remainder to maintain. At Torquay the company is in a most curious position, for while there have been no serious complaints by the inhabitants or the corporation, the Board of Trade has refused to license the lines there after October 30, owing to the large number of live studs. Thus, unless the overhead system be substituted, the whole tramway system must come to a standstill. But the corporation objects to overhead, hence the arbitration. The story of the company's perseverance to make the system a workable one and at the same time financially successful, is really a creditable one. No less than $100,000 have been spent in attempts to perfect the studs and their mechanism, but without much success. After all this, there are "live" and "dead" studs, and on one run of a mile there were no less than sixty-three extinctions of the lights due to dead studs. So frequent are "live" studs that a supply of insulating material is carried on every car for placing over a "live" stud when detected by the conductor or motorman, a part of whose duties it is, by the way, to test for "live" studs on curves. On the other hand, it is no uncommon experience for a car to come to a standstill on a dead stud and have to be crowbarred onto the next live stud. The corporation is suggesting that the company should adopt the G. B. or Lorain system, but the experiences of the past with surface-contact traction are leading to a desperate resistance on the part of the company.

It has been definitely decided to hold an electrical exhibition in London in October next year, under the auspices of the National Electrical Manufacturers' Association.

The Electro-Metallurgical Society has been formed for the study of the application of electrical processes to metallurgy. Prof. Arnold of the Sheffield University is the first president.

Strange as it may seem, the Belfort Corporation is just making its first experiment in street lighting, two streets being dealt with. Should the trials prove successful a more comprehensive scheme will be prepared.

A contract has been entered into for equipping thirty miles of railway with the system of telephones mentioned in these notes a short time ago. The London, Brighton & South Coast Railway Company has taken the system up, and one of its expresses, the Southern Belle, is to be equipped with the necessary apparatus for messages to be received and transmitted on the journey.

Prof. E. Rutherford is representing Great Britain at the International Congress of Radiology and Electricity in Brussels this week.

A new cotton mill, designed solely for electric driving, is under construction in Yorkshire. Fifty three-phase motors will be installed, aggregating 1,000 horsepower, each of them driving a single-ring frame through a clutch. All the motors will be started up by switching direct onto the line, and they are designed to take from five to six times the full-load current momentarily at starting. G.

CONTINENTAL EUROPE.

(Special Correspondence.)

PARIS, SEPTEMBER 15.—In Switzerland there is considerable activity in building short electric lines, most of which are narrow gauge. Concessions have been granted by the government for ten different electric-traction roads within the period extending from June, 1909, to May, 1910. The longest of these lines is to run between Zernez and Münster, and it will be thirty-two miles long. A second line runs from Bex to Handieres and a third from Trogen to Walzenhausen. The total length of the lines which have been conceded within the above period is about sixty-five miles. At the same time the work upon a number of other lines for which the rights were already granted is being carried on, among these the Wil-Constance line, and the road running from Lugano to Dino.

Following the new programme for the supply of current for Paris, which is soon to be carried out, there will be two large electric plants erected in the suburbs, one at Issy and the second at St. Ouen. In both plants it has been decided to use steam-turbine groups of 12,500 kilowatts. Such groups, built on the Brown-Boveri system, are already running in the St. Denis plant and have given great satisfaction, hence the choice of the turbine groups for the new plants. There will be installed ten units in the first-mentioned station and seven in the second, allowing for a future increase. As to the alternators, the two-phase system at 13,000 volts will be used. On the same shaft will be mounted two direct-current generators in order to furnish the exciting and motor current.

Observations made by Dr. Rohland of Stüttgart show that leakage currents have a bad effect on reinforced concrete, even when such currents are weak, provided they act for a very long period. The passage of the current in the iron acts to destroy the adherence between the iron and the cement, so that the metal is no longer protected and is likely to rust from air and moisture. The remedy is to coat the cement with asphalt or similar paint in order to prevent the current from passing.

Among recent electric projects in France, I note that the South Electric Company has obtained the rights for the electric lighting of the town of Mazan. The Municipal Council of Calais will probably grant the concession for an electric lighting system to the Compagni Generale. The towns of Marcenat and Grandignan are engaged upon lighting projects.

The International Congress of Telegraph and Telephone Engineers which was held at Paris has just closed. The delegates represented leading engineers from all parts of Europe and also from America, and papers were read in different languages. Outside of the work of the congress proper, the Paris committee organized an interesting programme in order to allow the delegates to see different technical features of the city.

One of the largest hydraulic plants in France is the recently-erected station of Tuiliere, in the rgion of Bordaux, and it works upon a network of power lines which belong to the Southwest Electric Company. The new plant has an output of 25,000 kilowatts and uses three-phase alternators at 5,500 volts, while the power line is operated at 50,000 volts. A. DEC.

EASTERN CANADA.

(Special Correspondence.)

OTTAWA, ONT., SEPTEMBER 24.—A telephone convention, consisting of the managers of the Bell companies in the United States and Canada, took place this week at Montreal. Upwards of a hundred officials, especially those engaged in long-distance work, met for the discussion of the problems of the telephone.

A power concern of Campbellford, Ont., is seeking to supply power to the city of Kingston at a rate of $25 per horsepower. This new company has acquired interests for development of power at Healey's Falls and Trent River. If negotiations go through, the construction work of the plant will begin at once so that power may be delivered within one year.

The ceremonies in connection with the official turning-on of the first hydroelectric power to be delivered in the province of Ontario, will be held in the city of Berlin, Ont., during the latter part of October. The municipality will give a banquet in honor of the occasion, at which members of the Ontario Government will speak. The Hydro-Electric Commission has secured an option of 15,000 horsepower from the New York & Ontario Power Company, to supply power to Morrisburg, Prescott and other Eastern Ontario municipalities.

The Dorchester Electric Company, of Quebec, has obtained supplementary letters patent permitting it to increase its capital to $1,000,000. The Company already has a dam, forty-eight feet high, on the River Etchemin, and this is to be enlarged, and electric power generated. The indicated policy of the company is to offer opposition in the city of Quebec and vicinity to the Quebec electric merger. The merger people, however, effect to believe that the opposition from the new concern will not be a serious matter.

About fifty representatives of the municipalities of the Western Power Union under the Hydro-Electric Commission of Ontario, met at London, Ont., this week, and voted unanimously in favor of permitting the export of 10,000 horsepower from Windsor, Ont., to Detroit, Mich. The service will be supplied only on condition that such service shall be terminable on reasonable notice, and that all profits on such service shall be appropriated so as to be equitably advantageous to all Ontario municipalities supplied by the Commission from the Niagara Falls transmission system. The power will be sold in Detroit at $45 per horsepower, while in Windsor it will be sold at about $22. Detroit will not therefore compete with Windsor.

MEXICO.

(Special Correspondence.)

MEXICO CITY, MEX., SEPTEMBER 21.—The Mexican Northern Power Company, the Canadian concern which is constructing a great hydroelectric power plant on the Conchos River, nineteen miles from Santa Rosalia, has enlarged upon its original plans. The holding corporation of the company is called the Conchos River Agricultural and Electric Power Company. It is now authoritatively announced that the plans which have been adopted and are now being carried out call for the expenditure of approximately $20,000,000 gold. One-half of this sum will be used in the construction of the mammoth dam across the Conchos River and the installation of the electric power system; the remaining $10,000,000 will be expended in the construction of one of the largest systems of irrigation upon the continent.

The English firm of S. Pearson & Son, which has constructed great public works for the Mexican government and in other parts of the world, has the contract for the construction of the dam across the Conchos River at the point where the hydroelectric plant will be installed.

The initial capacity of the hydroelectric plant will be 40,000 horsepower, and this will be later increased to 90,000 horsepower. The electric power transmission lines will radiate in various directions from the central plant. One line will run to Chihuahua and the great mining camp of Sant Eulalia; another to the town and mining district of Parral; another to Jiminez and Santa Rosalia, and another to Santa Barbara. It is stated that tentative contracts have already been entered into for the use of the full amount of power that the initial plant will generate. The use of this electric power will greatly cheapen the operations of mines and smelters and industrial plants generally in a wide scope of territory.

The company owns 250,000 acres of land, situated in the region adjacent to the site of the proposed artificial lake. It is planned to irrigate all of this great tract from the water of the lake. The survey for the proposed system of canals and ditches has been made and their construction will be started as soon as the work on the dam is a little farther advanced.

In order to provide a means for transporting the material for the dam and hydroelectric plant to the site of their location a railroad nineteen miles long has been constructed from Santa Rosalia by the contractors. This road is standard gauge and will be taken over by the Company when the construction work on the dam and power enterprise is finished. D.

IMPORTANT DEVELOPMENTS.

(Special Correspondence.)

NEW GENERATORS FOR NECAXA PROJECT.—The Mexican Light and Power has completed the hydraulic work of the Necaxa power house and two new alternating-current generators are to be installed within a few weeks. Each of these machines has a normal rated capacity of 12,500 kilovolt-amperes at 4,400 volts. When the Mexican Light and Power Company has installed the two generators as aforesaid, they will have available a total of 40,400 horsepower, additional to their present capacity and will therefore be in a position to meet almost any reasonable demand for power within the range of their transmission lines. The generators were supplied by the General Electric Company.

WILL BE LARGEST PLANT ON THE COAST.—A power plant which will develop 100,000 horsepower is being constructed by the Pacific Coast Power Company, a Stone & Webster concern, on the White River, near Buckley, Wash. Water will be taken from the White River about one-half mile above Buckley and will be conveyed through a canal to Lake Tapps, a distance of eight miles. The water impounded in this lake will be conveyed through a tunnel to the power house, where it will be delivered under an effective head of 450 feet. The first installation will be for 36,000 horsepower and other machinery will be added as the market demands.

ELECTRIC RAILWAY IN BRAZIL.—The corner stone was recently laid for one of the two 32,000-horsepower power stations which will supply current to an electric railroad between the port of Victoria and the city of Itabira, in the state of Minas Geraes. The railway will be about 400 miles long and will tap one of the greatest sources of Brazil's wealth in iron ore. One of the large waterfalls on the river Doce will furnish the power for one of the stations, and a large waterfall on a tributary stream power to the second station. At Itabira it will connect with the Central of Brazil Railway, with which it will have mutual traffic agreements. It is expected to thus land at least 3,000,000 tons of ore annually at Victoria at an estimated cost for transportation of about four-tenths of a cent per ton mile. About 250 miles of an existing steam railroad are to be utilized for this railway, the gauge to be changed from narrow to standard. The electrical equipment is to be furnished by a British concern, the entire project being financed by British capital interested in the development of the iron ore deposits.

COMMISSION NEWS FROM NEW YORK.

(Special Correspondence.)

The Public Service Commission, Second District, has received complaint from the Islip Electric Light Company of Islip, Suffolk County, against the Sayville Electric Cable Company. The Islip Company is now exercising franchise for electric service in East Islip and claims that the Sayville Company has entered its field and constructed necessary transmission lines and is serving electric current there without having obtained necessary franchise from the local authorities. The Sayville Company in entering the complaint claims that it has received the necessary franchise from the authorities of the town of Islip, which gives it the right to carry on the business of lighting by electricity in the villages within that town.

The Commission has granted its permission and approval for the exercise of a franchise granted to the Avon Electric Company by the town board and town superintendent of highways of the town of Geneseo for the purpose of furnishing electric light service in that town.

The Commission has made an order requiring all telephone corporations to file on or before October 1, 1910, schedules showing all rates and charges of all kinds between points in this state and between each point upon its line and all points upon every line leased or operated by it and all points upon the line of any other telephone corporation whenever a through service or joint rate shall have been established between any two points. Each company is also required to furnish the Commission with each issue of its directory of subscribers.

The Commission has also made an order requiring all telephone and telegraph corporations to report all accidents happening in connection with the work of these corporations.

John Snyder, of No. 72 Dove Street, Albany, has applied to the electric department of the Municipal Gas Company for power to operate a fifteen-horsepower motor. He notified the Public Service Commission of his objection to a levied charge of $15 a month in addition to paying for actual current used. This the Company terms a readiness-to-serve charge, and hence before the Commission, Alexander Anderson sought to justify it on the ground that it represented a computed percentage covering depreciation and interest on the fixed capital. He said that at the end of 1909 the Company's books showed an invested capital of $700,000. Answering Chairman Stevens' interrogatory as to the specific statute under which the readiness-to-serve charge was justified, Attorney Niele F. Towner said the Company levied it in the absence of a law expressly prohibiting such a charge. This case, he added, was in the nature of a test to determine its justification. The whole question at issue, it was argued, was whether the Company had a right, in view of the laws of 1907 fixing a maximum charge for electricity, to make a charge for installation or readiness-to-serve.

The Commission heard Attorney John L. Wilkie, of New York, supporting the pending application of the Poughkeepsie Light, Heat and Power Company, Newburgh Light, Heat and Power Company, and Hudson Counties Gas and Electric Company for permission to consolidate into a corporation to be known as Central Hudson Gas and Electric Company. Newburgh, Poughkeepsie, and towns and villages in Dutchess, Orange and Ulster counties, receive gas and electric current from the petitioning companies. Mr. Wilkie believed an economy of operation would follow the merger. Supervisor H. W. Chadeyne, of town of Cornwall, appeared in behalf of consumers there.

Decision on the application was reserved by the Commission.

LIGHTING AND POWER.

(Special Correspondence.)

GILBERT, MINN.—J. B. Thompson has asked for an electric light franchise in this city. P.

CHARITON, IOWA.—The city proposes to lease its electrical light plant for twenty-five years. C.

CROSBY, MINN.—H. F. Pierce, of Bay City, Mich., will put in an electric light plant here. P.

HAZEN, ARK.—The Hazen Power Company is arranging for the construction of its electric light plant. P.

ATKINS, ARK.—W. F. Turner and J. W. Barker have been granted a fifty-year electric light franchise. P.

ST. CHARLES, ILL.—The city will soon install a new 300-horsepower boiler at the municipal lighting plant. Z.

GREENVILLE, TEX.—The Greenville Railway Company is about to begin the construction of a power house. P.

TIPTONVILLE, MO.—The Tiptonville Light & Power Company has been incorporated with a capital stock of $7,500. P.

FARIBAULT, MINN.—The Consumers Power Company is arranging to supply current to this city from its plant at Cannon Falls, Minn. P.

BATESVILLE, IND.—Batesville Electric and Power Company has been incorporated by J. A. Hillenbrand, A. W. Romweber and Harry Blank.

PERU, ILL.—Nine blocks in Peru will be lighted with ornamental lights, contracts having been placed for fifty-seven ornamental posts. Z.

MANKATO, MINN.—Farmers living along the line from here to the Rapidan dam are preparing to equip their homes and buildings for electric light and power. C.

DULUTH, MINN.—The Great Northern Power Company has commenced condemnation proceedings for a site at Beaver Creek for a dam and a storage reservoir. C.

LEWISTON, IDAHO.—E. H. Libby, head of the Lewiston-Clarkston Improvement Company, has applied for an electric lighting and power franchise in this city. A.

DECATUR, ILL.—The Decatur and Macon County Hospital Association will erect a new power house to supply power for the new $65,000 hospital which is to be erected in this city. Z.

HENRYETTA, OKLA.—As the result of a special election recently held here, B. T. Lilly and associates have been granted a franchise to install an electric light and power plant.

ONIDA, S. D.—The local town council has granted a twenty-year franchise to the Onida Electric Light and Power Company to install and operate an electric light and power plant.

MINNEAPOLIS, MINN.—A contract has been let to the Minneapolis Electric Motor Company to equip the South High School with program clocks and fire-alarm system for $2,237. C.

CLINTON, ILL.—The mayor has appointed a committee from the City Council to investigate the feasibility of using electric instead of steam power for the municipal waterworks system. Z.

PLUMA, S. D.—The Consolidated Power and Light Company has let the contract to Mullen & Rourke, of Deadwood, S. D., for the construction of an addition to its power plant. The cost will be about $40,000. C.

LOCKNEY, TEX.—Local capitalists are installing an electric light plant here. They expect to have the plant in operation in a short time. Work is now being pushed rapidly to completion.

WYOCENA, WIS.—The Columbia County Electric Light and Power Company has been incorporated with a capital of $25,000. Incorporators are M. V. S. Mallory, John Loughrey and Theo. H. Dimon.

VALE, ORE.—It is probable that a twenty-four-hour lighting service will be in force within a month. The local plant has been taken over by the Telluride Power & Investment Company of Salt Lake City.

BROADLANDS, ILL.—C. W. Kagerman of Villa Grove has closed a contract with the village to supply light for Broadlands from the plant at Villa Grove. New machinery will be installed at the Villa Grove plant. Z.

LEON, IOWA.—The work of stringing wires from Leon to Decatur on the lines of the Leon Electric Company is now under way. The buildings in Decatur to be furnished with current from the Leon power house, have been wired.

WEISER, IDAHO.—Charles L. House, of this place, has been awarded a contract for the installation of an electric pumping plant by the Weiser Pipe Line Company. Water will be pumped from the Snake River for irrigating purposes. A.

MARTINEZ, CAL.—The Board of Supervisors of this county have awarded to the Richmond Light and Electric Power Company, of Richmond, Cal., a franchise for an electric transmission line along the public highways of this county. A.

MASON CITY, IOWA.—The Missouri Iron Company, owning a large tract of land in this vicinity, has contracted for power from the Upper Iowa Power Company, and an 800-horsepower turbine and a 750-horsepower generator will be installed at once. Z.

CLEVELAND, O.—On the supposition that the city can save $150,000 in ten years by buying light, heat and power, instead of operating a private plant, the contract has been awarded to the Cleveland Electric Illuminating Company. The contract is for ten years.

TAYLORVILLE, ILL.—Dissention between the Taylorville Gas and Electric Company and the city has been ended, and by a resolution passed by the City Council the utilities company will be granted a twenty-five year franchise for the sale of light, heat and power. Z.

NEW YORK, N. Y.—The American Power and Light Company, of New York, has bought control of the water power of Preist Rapids, in the Columbia River, from the Hanford Irrigation and Power Company. The property of the Hanford Company is estimated to be worth $4,000,000.

DILLSBURG, PA.—Application has been made for a charter for the Dillsburg Light, Heat and Power Company, and this place will probably be supplied with power very soon. Present plans include the installation of a 200-kilowatt hydroelectric plant on the Yellow Breeches Creek.

MINNEOLA, N. Y.—A mortgage for $500,000, given by the Long Beach Power Company to the Lincoln Power Company has been filed in the County Clerk's office here. The money will be used by the Long Beach Company for improvements, etc., to the property owned by the Company at Long Beach.

DEERFIELD, MICH.—William Schraeder, owner of the Deerfield electric lighting plant, has wired Petersburg three and one-half miles from here, for electric lights, the power to be furnished from the Deerfield plant. Everything is now in readiness for operation. Farmers all along the route will also be furnished with light.

SAN FRANCISCO, CAL.—Charles C. Moore & Company, of this city, are installing eight 450-horsepower Babcock & Wilcox boilers, ten Copes feed-water regulators, a Hamilton-Corliss engine, and a 2,000-kilowatt General Electric generator in the East Side power plant of the Portland Railway, Light and Power Company, of Portland, Ore. A.

VICTOR, MONT.—The Missoula Light and Water Company recently purchased the electric plant here, and will make it a part of the extensive system of power stations which is being developed between Missoula and Hamilton. The entire light and power system of the valley is to be operated from Missoula, with the principal branch office at Hamilton.

BALTIMORE, MD.—The Baltimore County Commissioners have granted to the Susquehanna Transmission Company of Maryland permission to cross certain public roads with its electric wires. The company will convey electric power from McCall's Ferry, Pa., to Baltimore. The line for the delivery of power to Baltimore is being rushed.

BARSTOW, CAL.—The Santa Fe is soon to commence work on the erection of a $75,000 electric light plant here. The new plant is made necessary by the new depot and hotel which is now nearing completion. At present a small plant furnishes lights to the roundhouse and depot, but it has not sufficient capaity to supply the needs of the new building.

GRAND FORKS, N. D.—The work of extending electric lighting facilities and gas mains, instituted by the Red River Power Company, is moving rapidly. The Company has now completed the erection of between eighteen and twenty miles of poles and wires are now being strung. Contracts have been secured for lighting 150 more of the homes of the city.

HARRISBURG, PA.—A number of electric light companies have been chartered recently, among which are the following: Aliquippa Electric Company, Aliquippa; Glenboro Electric Company, Haysville Borough Electric Company, Moon Township Electric Company, Leet Township Electric Company, Harmony Township Electric Company, Hopeville Electric Company, West Side Electric Company.

SHAWNEE, OKLA.—It is reported that the Rock Island is planning the expenditure of $75,000 at the Shawnee shops for an electric plant for its own use. It will be used both for lighting and power. The past two years the Rock Island has been experimenting with electric motors in the planing mill and some other departments, getting power from the Shawnee Gas and Electric Company.

HAZEN, ARK.—The Hazen Power Company is making arrangements to establish a large plant at this place. The contract for the machinery calls for one 250-horsepower Corliss engine and a battery of boilers. Electric generators will also be installed. It is expected the plant will be completed and ready for service by March 1. A ten-ton ice plant is to be operated in connection with the light and power plant.

DENVER, COLO.—The Federal Light and Traction Company of this city has contracted, through Sanderson & Porter of New York City, for electrical machinery to be used in its power plant. The two 1,250-kilowatt-ampere turbo-generators are to be three phase, sixty-cycle, 2,300-volt machines. This order also includes exciters, a Tirrill regulator, transformers, lightning arresters, disconnecting switches and switchboard.

TACOMA, WASH.—Bids were received by the city for the construction of an electric substation at Twenty-fourth and Adams streets from Blows & Tuell, Tacoma, $103,874; Huntington & Drack, $114,000, and the Sound Engineering & Construction Company, Seattle, Wash., $123,000. The engineer's estimate was $104,000. The building will be two-story, 62 by 174 feet, and equipped with transformers and twenty-ton traveling crane. C.

BALTIMORE, MD.—Announcement was made recently by Richard B. Fentress, of Norfolk, head of the Baltimore Electric Light and Power Company, that all opposition to the development of the Fentress-Mediary lighting franchise had been withdrawn and that he would be ready soon to enter into competition in the electric lighting field in Baltimore. Mr. Fentress declared he was now ready to spend $2,500,000 on the plant.

STERLING, ILL.—The Sterling Hydraulic Company has rejected a proposition from the J. G. White Company of New York to rent the new power station at the government dam for a period of thirty years. It was voted that a proposition be made to Chester Griswold, a member of the White Company, that a new company be formed consisting of the members of the present Hydraulic Company to take over the new power plant, refund the money invested there by the R. Griswold Wire Mill Company and pay a better annual rental per horsepower to the old company than that offered by the White Company. Z.

ELECTRIC RAILWAYS.

(Special Correspondence.)

BESSEMER, MICH.—A franchise for a street car line has been granted to Messrs. Appleyard, Sullivan and others. C.

GOLDENDALE, ORE.—Preliminary surveys are being made for an electric line to run from Lyle to Camas Prairie.

LOS ANGELES, CAL.—The Los Angeles Railway Company has authorized a bond issue of $15,000,000 to cover the improvements and extensions now under way. A.

RICHMOND, VA.—An amendment has been issued to the charter of the Washington-Virginia Railway Company, of Falls Church, increasing the capital stock from $1,000,000 to $3,000,000.

ROCK ISLAND, ILL.—It is now evident that electric service on the Rock Island Southern will not be started much before November. Work in the power house at Edwards River is proceeding slowly.

SPRINGFIELD, ILL.—The Wabash railroad is electrifying its repair shops at Springfield, taking out the old steam service. Power will be supplied by the Springfield Light, Heat and Power Company. Z.

GREAT BARRINGTON, MASS.—Indications are that work will soon be started on the Canaan trolley extension. The camp for the workmen employed on the line is being built about two miles south of here.

DES MOINES, IOWA.—The members of the Greater Des Moines Committee have pledged themselves to raise $200,000 to build the proposed Red Oak Interurban. Much has already been done toward securing money to build the road.

BLUEMONT, VA.—The Washington-Virginia Railway Company, which has been organized to build an electric railway from Bluemont to Vienna, Va., a distance of fifty miles, has been authorized to increase its capital from $1,000,000 to $3,000,000.

JERSEY CITY, N. J.—The Cumana & Campano Pier & Tramway Company has been incorporated to operate tramways, street car lines, etc. The capital is $500,000, and the incorporators are Emil Ruen, Charles Freeman and Louis H. Gunther.

EAST ST. LOUIS, ILL.—The Southern Railway of Illinois, the line of which, it is announced, will be completed between East St. Louis and Belleville probably by the end of the present year, will enter St. Louis by the municipal free bridge, if permission is obtained from the Missouri city. Z.

INDIANAPOLIS, IND.—The State Board of Tax Commissioners has placed the total valuation of the electric railroads in Indiana at $22,376,238. This is an increase in valuation over that made in 1909 of $840,197. This increase is due to the completion of several roads in northern Indiana. S.

SPRINGFIELD, MO.—Work began recently on the survey of the Springfield & Western Railroad, an electric line to be constructed from this city to Pierce City, to connect there with a line to Joplin. The new road will be known as the Jersey Route because of the exceptional dairy business in the country through which it passes.

MILWAUKEE, WIS.—President John I. Beggs, of the Milwaukee Electric Railway and Light Company, has created at West Allis a new division for handling suburban business. Tracks have been laid north of the company's substation at West Allis for the storage of 100 cars. It is expected that the new pay-as-you-enter cars will be delivered about November 1.

YORK, PA.—Dillsburg business men, with several Philadelphia bankers, will organize a company and will capitalize at $180,000 for the purpose of building a trolley road from Dillsburg to Dover. The distance is about fifteen miles. It will reach a number of industrial plants which have hitherto been shut off from the outside world except by private conveyance.

LOS ANGELES, CAL.—Two petitions of the Huntington interests for franchise privileges have been presented to the City Council. One is for a twenty-year franchise on San Pedro between Seventh and Aliso Streets; the other for a twenty-one-year franchise extending from Sixth and Alverado Streets south on Alvera to Hoover, thence on Hoover to Jefferson, thence on Jefferson to Central, thence on Central to Vernon Avenue and east on Vernon to Santa Fe Avenue. A.

COLUMBIA, PA.—Surveys have been made recently for an electric railroad to New Oxford from Dover, York County, via East Berlin. The line is already in operation from York to Dover and the supposition is that the survey is for a connecting link with the line from McSherrystown to New Oxford, making the circuit from Spring Grove, Hanover, McSherrystown, New Oxford, East Berlin and Dover. The line surveyed is by way of Pine Run and enters New Oxford on the north side of the York Pike.

SALT LAKE CITY, UTAH.—According to reports from official sources, the electrification of the Salt Lake-Nephi branch of the Salt Lake Route is being seriously considered, both as a matter of convenience and for reasons of economy. In that event, there will be no extension of the interurban line of the street railway beyond Sandy. The idea of a line west of Midvale and south on the Redwood Turnpike has been given up.

LEBANON, PA.—The work of building the electric railway between this place and Ephrata will be started this fall and continued during the winter. The road will be about twenty-three miles in length, and will tap a rich agricultural and cigar manufacturing district in two counties, North Lancaster and Southern Lebanon, including several towns, Schaefferstown and Lincoln, and hamlets like Iona, Reistville, Kleinfeltersville, Hopeland and others. The cost of construction will be approximately $400,000.

YOUNGSTOWN, O.—Present indications are that the proposed electric line between this city and Canton will be built under the name of the Canton, Akron, Youngstown & Alliance Railway. The proposed route to this city is via Hartwell, Randolph, Atwater and Deerfield. Two routes from Deerfield to this city have been selected, one is south of Berlin station through Canfield, and the other north of Berlin through Austintown. The estimated cost of building and equipping the road is $4,000,000.

BRISTOL, IND.—H. E. Bucklen, who is promoting a traction line from this city to Kalamazoo, Michigan, a distance of forty-eight miles, says that work will begin on the line as soon as a few pieces of property can be purchased to complete the right-of-way. This road when built will connect with the Valley system owned and operated by Mr. Bucklen. Work is progressing on the extension of the Valley line between Bristol and Middleburg. When this is completed the plan is to extend the power circuit and operate cars by electricity instead of gasoline motor power. S.

DEFIANCE, O.—Unless this city permits the charging of a straight five-cent fare by the Defiance Street Railway Company, owned by W. P. Engel, he threatens in a recent communication to abandon the system and leave the city without street-car service. Engel claims that the cars are now being operated at a loss, but that he has continued to operate because it appears better for the town. Six tickets for a quarter are provided by the franchise, or thirty tickets for a dollar, but for several months a straight five-cent fare has been charged, all tickets being called in. H.

DELPHI, IND.—The project to build an interurban road from Delphi to Burlington via Flora has been revived. E. W. Bowen, president of the Delphi, Flora and Burlington Traction Company, reports that he has found a syndicate willing to build and equip the road ready for operation for the amount of the subsidies voted and a small bonus besides. The additional money is now being raised and there is every prospect of the road being built and in operation by July 1 next year. This road will make connection with a line into Indianapolis and a line to Ft. Wayne. S.

TOLEDO, O.—A resolution has been introduced into the City Council asking the city solicitor to bring action for the forfeiture of the franchise of The Ohio Electric Railway, on the grounds that the Company had not complied with the provisions of its agreement to station gates and watchmen at City Park Avenue, South Street and Western Avenue. The city now wants the same protection at several other crossings. The resolution was referred to the Committee on Railways and Telegraph for report, and unless the matter is adjusted litigation involving the rights of the company will follow. H.

BLOOMINGTON, WIS.—Announcement has been made of the organization of the Grant Railroad Company to build a line twenty-six miles long from Woodman, Wis., through Patch Grove and Mount Hope to Bloomington. The towns of Little Grant, Patch Grove, Bloomington and Mount Hope have voted $130,000 in bonds to help finance the road and most of the remainder of the stock will be taken up by Grant County capitalists. The new road will connect with the Milwaukee road in Woodman. William T. Leighton, Little Grant, is president, and W. E. Lewis, Patch Grove, secretary and treasurer.

LEBANON, PA.—The Hummelstown and Campbellstown Street Railway Company, of which Milton S. Hershey, the Hershey chocolate manufacturer, is the head, is said to be planning the building of a five-mile extension from Campbellstown to Bismarck and a five-mile extension from Bismarck to Lebanon within a year. The line will be a feeder to the Hershey chocolate plant's milk collection routes, which will have a station in this city, where a branch of the Hershey factory is now located. Mr. Hershey is said to be planning another extension from the Hummelstown and Campbellstown Railway, running from Hershey to Manada Hill, several miles to the northward, where a big summer hotel may be erected.

GREENVILLE, S. C.—Following the announcement of the purchase of the Greenville Traction Company and Electric Light Company, local holdings of the American Pipe Company, by the Southern Power Company, developments have taken place in the Greenville, Spartanburg and Anderson Railroad which indicate that that interurban trolley line will be pushed through at once. At a meeting of the directors of the Greenville, Spartanburg and Anderson Company, held in New York, the capital stock of this company was increased to $2,000,000 and it is understood that the Greenville Traction Company will be taken over by the interurban. It was also said at headquarters that the work of construction from Belton, the present terminus, to Greenville will be commenced at once. The concern is controlled by the Duke interests.

TELEPHONE AND TELEGRAPH.

(Special Correspondence.)

WHITE EARTH, N. D.—The installation of a telephone system is being agitated. C.

ROLFE, IOWA.—The Rolfe Telephone Company is placing its wires underground at a cost of $7,000. C.

DUNDEE, MICH.—The Farmers' Telephone Company has been incorporated with a capital of $10,000.

PERRY, ILL.—The Pike County Telephone Company has purchased the Doan lines in and near Perry. Z.

MILNOR, N. D.—The Milnor Rural Telephone Company has built thirty miles of new lines the last summer. Z.

ARMOUR, S. D.—John P. Walz, John A. Meyer and Sam Teske have incorporated the Howard Telephone Company, capital $1,000, to build a rural line in Howard township. C.

PIERRE, S. D.—The Dakota Central Telephone Company is about to commence the installation of an automatic system in the new state capitol. C.

COLFAX, IA.—The Colfax Telephone Company has secured a site for the erection of a telephone building, construction on which will be commenced at once.

STILLWATER, O.—The Stillwater Telephone Company has been incorporated with a capital of $5,000. Incorporators are: A. Dornberger, N. Dornberger and B. H. Kinsey.

FREMONT, NEB.—The telephone poles are to be removed and all wires placed in underground conduits. The Nebraska Telephone Company will also build a new exchange here.

JOCKEYTOWN, IND.—The Lane Telephone Company has been incorporated with a capital stock of $3,000 by W. F. Hay, T. C. Hay, C. T. Walker, J. C. Stephens and F. B. Douglas.

HEDGEVILLE, MONT.—The Montana State Telephone Company has been incorporated with a capital of $25,000. The incorporators are W. E. Ford, H. W. Banger and John Burke.

BOWMAN, N. D.—The Dakota-Montana Telephone Company, covering a wide territory in this section, will soon enter Bowman, plans with that end in view now being under consideration.

WINDSOR, CAN.—The Dominion Wireless Telegraph and Telephone Company, Ltd., has been incorporated to deal in electric goods and raw products. The incorporated capital is $40,000.

MERCERVILLE, O.—The Mercerville Union Telephone Company has been incorporated with a capital of $2,500. The incorporators are: J. N. M. Davis, S. W. Williams, E. L. Sheets and Samuel Lewis.

MEMPHIS, TENN.—Work was recently started on the construction of a new telephone line which is to extend the entire length of the St. Francis levees, about sixty miles. The cost of the extension is estimated at $12,000.

BELLOWS FALLS, VT.—The new England Telephone and Telegraph Company will rebuild the toll line from Bellows Falls to Claremont, N. H., retransposing the circuit between Boston and St. Johnsburg at the same time.

DECATUR, IND.—The Citizens' Telephone Company, which is owned entirely by local capital, has declared a dividend of eight per cent. The directors say they are in the market for wire and other material for extending its toll lines. S.

MEDICINE HAT, ALTA.—The Alberta Southeastern Telephone Company, which owns the line between Medicine Hat and Cypress Hills, has received an offer from the government for the purchase of the line. The transfer will probably be made.

LANSING, MICH.—The Farmers' Telephone Company of Dundee and Azalia has filed articles of incorporation with the secretary of state. The new company is capitalized at $10,000. Dundee is mentioned as the principal office of the new company.

SCENERY HILL, PA.—A charter has been granted to the Marianna and Scenery Hill Telephone Company, which is incorporated with a capital of $7,500. The incorporators are J. W. Shidler, S. G. Fulton and C. Woonsetler, all of Marianna.

SUMMERVILLE, GA.—The Southern Bell Telephone Company is completing the equipment and installation of a new central exchange at a cost of $60,000. As a city ordinance requires all wires to be placed underground before January 1, 1911, many of the wires are now being put in conduits.

MARSHALLTOWN, IOWA.—A new independent telephone company has been organized to compete with the Marshall Telephone Company. At a meeting which was held, $20,000 worth of stock was subscribed and it is expected that $130,000 more will be raised. Connections will be made with rural lines.

INDIANAPOLIS, IND.—The total valuation of telephone lines in Indiana has been placed by the State Tax Commissioners at $11,146,832, against $10,096,284 for 1909. In 1905, the first year the tax board was organized, the telephone property was placed at $7,872,496. This is a gain of $2,274,332 in five years. S.

ALEXANDER, N. D.—Telephone connections will be established within the next two months with a good circuit of McKenzie County towns, the Dakota Western Telephone Company having let the contract for the work. The line is to run from Stroud to Alexander, Arnegard and Schaffer, and will take care of an immense territory lying between those cities.

MUSKEGON, MICH.—The Citizens Telephone Company of Muskegon has been placed under joint management with the United Home Telephone Company of Oceana and Mason counties, making a continuous system between Grand Rapids and Manistee. William Robinson, who has been the local manager for the past fifteen years, has resigned, and Thomas Bromley, Jr., will act as general manager of both companies.

GREENSVILLE, S. C.—The State Railroad Commission, after no little discussion of the issue by citizens and others, has granted the local Southern Bell Telephone Company the right to increase its telephone rates according to a schedule previously filed, upon the agreement of the Company, or its offer, to expend $100,000 in making improvements on the local system at this point. A central-energy exchange and underground conduits are among the principal improvements mentioned. The Company will build a reinforced-concrete exchange building costing about $16,000. In the basement will be installed an auxiliary gasoline engine and plant for use in case of emergency. The order of the Railroad Commission has been signed by the secretary and two of the three members. The increased rates are not to become effective until the improvements named have been installed, including underground cables in the business section, and a thoroughly modern equipment. L.

ELECTRICAL SECURITIES.

The price of stocks advanced to a marked degree during the past week despite the fact that trading was rather light. Some significance was attached to the report that the master in chancery for the United States Circuit Court of Appeals in Minnesota had decided the schedule of rates prescribed by the Railroad Commission of that state invalid upon the ground that they were confiscatory and interfered with interstate commerce. The rise in stocks following receipt of this report was checked when it was realized that the master's finding would have to be reviewed by the higher courts. Impetus was given to activity in local traction securities by reports that J. P. Morgan and Company, the National City Bank and the First National Bank are to take a closer interest in the Interborough-Metropolitan Company, of New York, the report which gained most credence being that an issue of bonds to cover third-tracking of the East Side elevated roads and a tube to Queens is to be forthcoming shortly, in which these banking interests will take a hand.

At the annual meeting of the Union Traction Company, Philadelphia, directors were re-elected.

Directors of the Philadelphia Rapid Transit were re-elected at the annual meeting.

At the annual meeting of the Railways Company General it was voted to change the date of the annual meeting from the third Monday in September to the third Monday in February and also to change the date of the fiscal year from June 30 to December 31. The meeting last week was adjourned, no election being held.

The financing voted by the Philadelphia Union Traction stockholders, at the annual meeting, was merely a formal matter. The proposition was to increase the indebtedness of the company from $1,500,000 to $3,000,000, such increase being the guarantee of the rental of the equipment lease of the Philadelphia Rapid Transit Company, if the requirements of the law should regard the guarantee as an increase in the indebtedness. No additional financing is contemplated under the authorization of this meeting.

DIVIDENDS.

American Cities Railway and Light Company; regular quarterly dividend of one and one-half per cent on the preferred stock, payable October 1 to stock of record September 21.

American Gas and Electric Company; quarterly dividend of one and one-half per cent on the common stock, an increase of one-half of one per cent quarterly, payable October 1 to stock of record September 23.

American Telephone and Telegraph Company; quarterly dividend of two per cent.

Chicago City Railway Company; quarterly dividend of two and one-half per cent, payable September 30.

Detroit-Edison Company; quarterly dividend of one and one-half per cent, payable October 15.

Electric Storage Battery Company; common quarterly dividends on both common and preferred stocks, payable October 1.

Kansas Gas and Electric Company; regular quarterly dividend of one and three-fourths per cent on the preferred stock, payable October 1 to stock of record September 26.

Mexican Telephone and Telegraph Company; preferred semi-annual dividend of two and one-half per cent, payable November 1.

Tri-City Railway and Light Company; preferred quarterly dividend of one and one-half per cent, payable October 1.

Union Switch and Signal Company; regular quarterly dividends of three per cent on both the common and preferred stocks, payable October 10.

Westinghouse Electric and Manufacturing Company; back dividends of eight and three-fourths per cent on the preferred stock,

payable three and one-half per cent October 15, three and one-half per cent January 15, one and three-fourths per cent April 15. The regular quarter dividend of one and three-fourths per cent is payable October 15. Books will be closed October 5 and reopened October 16.

CLOSING BID PRICES FOR ELECTRICAL SECURITIES IN THE LEADING EXCHANGES AS COMPARED WITH THE PREVIOUS WEEK.

NEW YORK.

	Sept. 26.	Sept. 19.
Allis-Chalmers common	8	8
Allis-Chalmers preferred	29	29
Amalgamated Copper	61½	63
American Tel. & Cable	69½	*80
American Tel. & Tel	137	124½
Brooklyn Rapid Transit	76	75¼
General Electric	142¾	142
Interborough-Metropolitan common	21⅝	21¼
Interborough-Metropolitan preferred	57	55¾
Kings County Electric	123	122
Mackay Companies (Postal Telegraph and Cables) common	92	88
Mackay Companies (Postal Telegraph and Cables) preferred	73½	73⅝
Manhattan Elevated	137½	133¾
Metropolitan Street Railway	*18	*18
New York & New Jersey Telephone	103	103
U. S. Steel common	67⅝	67¼
U. S. Steel preferred	116¼	115½
Western Union	65¼	64½
Westinghouse common	61	59
Westinghouse preferred	*130	*125

*Last price quoted.

BOSTON.

	Sept. 26.	Sept. 19.
American Tel. & Tel.	137¼	134½
Edison Elec. Illuminating	257	256
General Electric	142¾	142
Massachusetts Electric common	18	17
Massachusetts Electric preferred	81	81
New England Telephone	128½	130
Western Tel. & Tel. common	16	15
Western Tel. & Tel. preferred	83	83

PHILADELPHIA.

	Sept. 26.	Sept. 19.
American Railways	43	43¼
Electric Company of America	11½	11½
Electric Storage Battery common	47	47
Electric Storage Battery preferred	47	47
Philadelphia Electric	15⅝	15¼
Philadelphia Rapid Transit	18¼	17¾
Philadelphia Traction	81	81¾
Union Traction	43½	42¾

CHICAGO.

	Sept. 26.	Sept. 19.
Chicago Railways, Series 1	60	60
Chicago Railways, Series 2	15	13¾
Chicago Subway	4¼	4¼
Chicago Telephone	119	118
Commonwealth Edison	111	111½
Metropolitan Elevated common	17	18
Metropolitan Elevated preferred	60	61
National Carbon common	125	122
National Carbon preferred	118	119

PERSONAL MENTION.

D. P. ROBERTS, electrical engineer at London, Can., has been appointed electrical expert and inspector for the British Columbia government.

PARKER H. DAGGETT, formerly of Harvard University, has been made professor of electrical engineering in the University of North Carolina.

J. F. MEISTER, formerly of Cornell University, has been appointed instructor in electrical engineering at the Oregon Agricultural College.

ERNEST WILSON, radiographer at London Hospital, has undergone a sixth operation for X-ray dermatitis, and is compelled to retire from active work.

C. L. EMERY, manager of the Mount Vernon (Iowa) Electric Light Company, was in Chicago last week, and told of his experiences with advertising novelties.

ALEXANDER SHANE has resigned as chief inspector for the Railroad Commission of Indiana and will become general manager of the Indianapolis, Columbus and Southern Traction Company.

SIR OLIVER LODGE and SIR J. J. THOMSON received honorary degrees of Doctor of Science from Sheffield University, upon the occasion of the meeting of the British Association for the Advancement of Science.

FRANK L. FLANAGAN, who has been in the manager's office of the New York Telephone Company at Asbury, Park, N. J., was recently made traffic manager of the Troy, N. Y. district. Mr. Flanagan will have charge of seven offices.

ROBERT C. TAYLOR, for a number of years superintendent of motive power of the Indiana Union Traction Company, has resigned to accept the appointment of master mechanic of the Illinois Traction lines at Granite City, Ill., near St. Louis.

JOSEPH O'HARA, who recently resigned the office of superintendent of the Chicago, Ottawa & Peoria Railway to become the general manager of the Aurora, Elgin & DeKalb line, was the guest of honor at a farewell party given by the interurban employes, at his home in Ottawa, Ill.

GEORGE W. ARMSTRONG, western manager of the Excello Arc Lamp Company, New York, N. Y., has left Chicago for a two weeks' automobile tour through Ohio and neighboring states. Mr. Armstrong's trip, while of a business nature, will afford him a much-needed rest on the eve of a strenuous business campaign.

WILLIAM P. CHAPIN has been appointed Rochester manager for the New York (Bell) Telephone Company of the city of Rochester. Mr. Chapin, who is a graduate of Purdue University, has been in the employ of the New York Telephone Companies for the past two years. He was for a time connected with the Stromberg-Carlson Company.

WILLIAM ELLIOTT, who has served as the general manager of the Columbia Electric Street Railway Company, of Columbia, S. C., for several years, has resigned and will practice law, being succeeded as manager of the local street railway by Guy K. Dustin, of New York, the change becoming effective October 1. Mr. Elliott will be located in Columbia as a member of the law firm of Elliott & Herbert.

LE ROY P. SAWYER, president of the Buckeye Electric Company, Cleveland, O., and well-known lamp man, passed through Chicago with Mrs. Sawyer recently, on his way to the Pacific Coast, where he will spend a well-earned vacation. Mr. Sawyer has been actively engaged in directing operations for a strenuous fall campaign for his company and it is expected that this trip through Southern California and north through the Canadian Rockies to Banff will fit him for one of the most prosperous seasons of the Company's history. Mr. Sawyer expects to be gone six or seven weeks.

MATHIAS KLEIN, the senior member and founder of the firm of Mathias Klein & Sons, was agreeably surprised on Sunday, September 18, on his return from an afternoon outing, by the assembly of his descendents who had gathered at the old homestead to bring their congratulations for his eighty-fourth birthday. Mr. Klein still enjoys bodily and mental vigor. Born in the city of Worms, Hessedarmstadt, Germany, in 1826, he served his time as apprentice and journeyman in the Fatherland; however in 1848 determined to turn to the new land of promise. Until 1855, he resided in the city of Philadelphia, where he married, afterward moving to Chicago. He was employed until 1857 in the repair and mechanical department of Edwin Hunt, a prominent hardware merchant of that time. In 1857, Mr. Hunt decided to abandon this part of his business, and Mr. Klein took up the severed threads, with the best wishes of Mr. Hunt, and opened up on his own account in a small shop in Couch Place, between Lake and Randolph and Clark and Dearborn Streets. This was the birth of the present firm of Mathias Klein & Sons.

OBITUARY.

WILLIAM A. VAN ORDEN, general wire chief of the Western Union Telegraph Company in the main office, died on September 22 at his home in Brooklyn. He was prominent in the Telegraphers Aid Society and the Royal Arcanum. He is survived by his wife.

J. D. VOLTZ, for fifty-five years a telegraph operator and a member of the Civil War Telegraphers' Corps, died in Elgin, Ill., a short time ago. From Rome, Ga., he sent the message to President Lincoln outlining General Sherman's plan of his march to the sea. Last fall Mr. Voltz was retired on a pension by the Chicago & Northwestern Railway, after twenty-five years as station master at South Elgin.

DAVID B. PARKER, who had a wide acquaintance in the electrical field a decade ago, died on September 22 at his home in Ellicottville, Cattaraugus County, N. Y. During the Civil War he held a commission and was for a time in charge of the mail service of the Army of the Potomac. From 1876 to 1883 he was chief of postoffice inspectors. President Arthur offered him the postmastership at Washington, but he declined and accepted a position with the American Bell Telephone Company. He organized many of the branch companies in the United States. He was superintendent of the New England Telephone Company, with headquarters at Boston; later, general manager of the New York Telephone Company, and still later, general manager of the Bell Company of Buffalo. His wife and two sons survive him.

ARTHUR E. CROCKER died at the New York Hospital on Tuesday, September 13, 1910, in the seventy-first year of his age. Death was caused by pneumonia, following an operation. Mr. Crocker was born at Lestershire, N. Y., a suburb of Binghamton. He served throughout the Civil War in the Department of Military Railroads, and was confined in Libby Prison for about a year. During the last thirty years of his life he was engaged in the construction and maintenance of telephone and telegraph lines, and was one of the ablest and best-known telegraph men in the country, especially as a pole buyer and right-of-way agent. For the first five years of that period he was connected with the construction work of the Postal Telegraph-Cable Company. In 1885 he was employed by the American Telephone and Telegraph Company, and on August 20, of that year, near Hainesport, N. J., superintended the erection of the first pole set by the American Telephone and Telegraph Company, with which company he was associated at the time of his death, having represented its Legal Department in thirty-two states, including every state east of the Mississippi River, excepting Florida. His loyalty to his work and to his friends, and his keen, though kindly, sense of humor, endeared him to all who knew him.

PROPOSALS.

ELECTRIC CRANE.—The Board of Public Improvements, St. Louis, Mo., will let contracts October 7, for furnishing, delivering and installing one thirty-ton electric traveling crane and a steel runway for same. Maxime Rebr, president; W. B. Dryden, secretary. Z.

POST OFFICE, WILLMAR, MINN.—The office of the Supervising Architect, Washington, D. C., will receive sealed bids until October 24 for the construction, complete (including plumbing, gas piping, heating apparatus, and electric conduits and wiring), of the United States post office at Willmar, Minn., in accordance with drawings and specification, copies of which may be obtained from the custodian of site at Willmar, Minn., or at the Supervising Architect's office.

POST OFFICE, PONTIAC, MICH.—The office of the Supervising Architect, Washington, D. C., will receive sealed bids until November 14 for the construction, complete, (including plumbing, gas piping, heating apparatus, and electric conduits and wiring), of the United States post office at Pontiac, Mich., in accordance with drawings and specification, copies of which may be obtained from the custodian of site at Pontiac, Mich., or at the Supervising Architect's office.

LEGAL NOTES.

SALE OF STOCK ENJOINED.—The sale of stock of the Citizens' Light, Heat and Power Company, of Montgomery, Ala., amounting to $200,000, has been enjoined by a decree of Federal Judge Thomas G. Jones. The injunction also prevents the company from purchasing or making of any contract to buy or install machinery in the Citizens' plant, and prohibits the making or creating of any obligation outside of or beyond the necessary operation and conduct of the business of the Citizens' Company, and also prohibits the issuing of any additional stock without special leave of the court. The decree of the federal judge is that the property of the Citizens' Company shall remain *statu quo* to await the final adjudication of the legal controversy now on before this tribunal for the determination of the ownership of the Citizens' Light and Power Company.

OBLIGATIONS OF PUBLIC SERVICE CORPORATIONS AND OF MUNICIPAL OWNERSHIP.—Necessarily most public utilities are monopolies. Whether owned and conducted by municipalities, or by public service corporations, they deal in the prime necessities of urban life, and must be and are subject to the control of the courts, to the end that all classes of people may enjoy proper service, without discrimination or individual oppression. The law recognizes no distinction between municipal governments and public service corporations in the service of the public. Municipal ownership imposes the duty on the city to give reasonably good service, to treat all classes of citizens alike, and to impose only such rules and regulations as are reasonable and just.—Kansas City court of appeals in State vs. Jones, 125 S. W. 1169.

FAILURE TO USE STRAIN INSULATORS.—In a case where a lineman and cable inspector of a telephone company received a shock from a guy wire and recovered a judgment for damages, the court of appeals of Kentucky says that, whether strain insulators afford full protection or not, it is apparent that they are useful safeguards, and that, if the guy wires had been supplied with strain insulators the lineman in all probability would not have been injured. They are simple contrivances; and at places where guy wires are liable to come in contact with electric wires it was proper to submit to the jury the question whether or not the company exercised ordinary care in failing to provide the guy wires with these safety and inexpensive appliances. The lineman knew, or could have known, by the exercise of ordinary care that the guy wires were not provided with insulators, but the fact that they were not did not furnish to him any information or notice that the guy wires were dangerous or charged with electricity. He had the right to assume that the company would have supplied the guy wires with such devices as were necessary to protect its employes.—Citizens' Telephone Company of Kentucky vs. Wakefield, 126 S. W. 127.

INSUFFICIENT ANSWER TO OR COMPLIANCE WITH ORDINANCE REQUIRING INSULATION.—Where a corporation makes use of electric wires carrying dangerous currents in the streets of a city, under an ordinance requiring effective insulation, it is not a sufficient answer to the charge of falure to comply with its obligation, and to a demand for damages for injury and death resulting from such failure, for it to say that such insulation is unnecessary and expensive, and that other persons and other contractors have no reason for coming in contact with its wires. The necessity is determined by the ordinance, which is intended for the protection of persons who may come in contact with such wires without reasoning upon the subject, through accident, ignorance, inadvertence, or imprudence. The city of New Orleans has declared, by ordinance, that "electric-light and power conductors shall be secured to insulating fastenings and covered with an insulation which is waterproof and not easily abraded. Whenever such insulation becomes impaired, it shall be renewed immediately." The use in the streets of New Orleans upon electric conductors, carrying dangerous currents, of a cheap insulation, which, when new, is almost, and within a few months absolutely, worthless, is worse than no pretense of compliance with this ordinance, since it holds out an assurance of compliance upon which the uninformed may be led to rely.—Supreme Court of Louisiana in Moren vs. New Orleans Railway and Light Company, 52 So. 106.

CHARGE FOR REINSTATEMENT OF DELINQUENT ILLEGAL.—A provision in an ordinance of a city furnishing electric light to its citizens, that any person whose electric light may have been cut off for delinquency in payment may be reinstated upon payment of all bills in arrear and a penalty of fifty cents, is illegal. The city is not entitled to exact payment of a penalty of fifty cents as a condition precedent to a resumption of the discontinued service. An ordinance authorizing the city to discontinue the service of a delinquent customer is reasonable; for, obviously, neither a city nor a private corporation can run business successfully without some regulation. But, when the delinquent customer pays the amount due on his bills at the time the service was shut off, he is entitled to have the service restored, without the imposition of any penalties. Even on the theory that the penalty so called is nothing more than a reasonable charge to cover the expense of shutting off and turning on the light, the right to enforce it cannot be recognized. The expense of turning on and off the current enters into the monthly rates charged for the service. This is made certain by the fact that no charge, as such, is made to patrons for such service. If a man should change his residence in the city, his light would be turned off at his old abode and turned on at the new without extra charge. To force a delinquent to pay such extra charge would be to compel him to pay again for what he had already paid, and this not only would be discriminative, but would accord the city the right to use its monopoly as an instrument of extortion.—Kansas City Court of Appeals in State vs. Jones, 125 S. W. 1169.

NEW PUBLICATIONS.

ESPERANTO GRAMMAR.—*Amerika Esperantisto* has published a grammar of Esperanto in pamphlet form and is sending this free to anyone who is sufficiently interested to send a stamp. The address is 700 East Fortieth Street, Chicago, Ill.

STANDARD CLASSIFICATION OF ACCOUNTS.—The National Electric Light Association is mailing to Class A member companies a bound volume of the Standard Classification of Construction and Operating Accounts adopted by it. These are recommended for use by member companies. While it is not intended that every company should use the same number of sub-accounts, it is expected that the eight main divisions will be used by practically all companies. The uniformity of accounts thus secured would be of great value.

MAGNETIC OBSERVATIONS.—The United States Coast and Geodetic Survey has recently issued two bulletins covering the results of observations at the magnetic observatories at Baldwin, Kans., and Vieques, Porto Rico, in 1905 and 1906. Each bulletin gives a description of the instruments used, and tables of the diurnal variations of declination, horizontal intensity and vertical intensity of the earth's magnetic field. There is also a register of magnetic storms and earthquakes. The data has been compiled by D. L. Hazard.

ENCYCLOPEDIA BRITANNICA.—The University of Cambridge, England, announces that it has taken over the control and copyright of the Encyclopedia Britannica, and will publish a new and complete edition about the end of the present year. This eleventh edition, which has been eight years in preparation, entirely supersedes preceding editions, and is a "wholly fresh and original survey of all existing knowledge in every field of human thought, research and achievement." It will be comprised in twenty-eight quarto volumes, of which the last will be devoted to a full and comprehensive index.

NEW INCORPORATIONS.

CLEVELAND, O.—The Verlux Company has been incorporated with a capital of $30,000 by H. H. Woods, G. S. Waddle, Frank C. Woods and E. H. Rooke.

ST. LOUIS, MO.—The Electric Signaling Company has been incorporated with a paid-in capital of $50,000, by Charles H. Parshall, Herbert A. Vrooman and Arthur G. Mosely. The company will manufacture and deal in signal devices.

NEW YORK, N. Y.—The Hempstead South Development Company has been incorporated to manufacture and deal in electrical machinery, dynamos, etc. The incorporators are Leopold Schwartz, Martin H. Latner, William S. Miller and Buel C. Haff, all of New York City.

ONEONTA, N. Y.—The Lloyd Lighting Company has been incorporated to manufacture and deal in lamps, machinery, etc., for the production, use or appliance of light or heat. The capital is $2,100. Incorporators are: John F. Lloyd, Clarence C. Miller and Chauncey W. Herrick, all of Oneonta.

EVANSVILLE, IND.—The Bucyrus Vulcan Company has incorporated with a capital of $600,000. This company proposes to

build or establish and equip an immense factory for the manufacture of excavating and railroad building machinery. The new factory will be thoroughly equipped for operation by electricity in all departments. S.

INDIANAPOLIS, IND.—Articles of incorporation have been filed by the "Electric Lighting Company," capitalized at $100,000. The object of this corporation shall be to engage in the manufacture, sale and distribution of apparatus intended for the generation of electricity for lighting and other purposes to be used in connection with the lighting of vehicles; also to engage in the manufacture, sale and distribution of automobile parts and accessories, electric supplies, etc.

INDUSTRIAL ITEMS.

THE MARCONI COMPANY has installed wireless telegraph outfits on eleven warships of the Turkish fleet, and in a land station at San Stefano.

GEO. DRAKE SMITH, 1170 Broadway, New York, has taken the New York agency for the Hughes electric stove, made by the Hughes Electric Heating Company, of Chicago.

WICKES BROTHERS, Saginaw, Mich., have issued their monthly stock list for September. The Company sells machinery of all kinds and will also buy up entire plants or parts of them.

THE VICTOR ELECTRIC CO., Chicago, Ill., recently purchased, from McKinney, Hodge & Morris, a lot at the corner of Jackson Boulevard and Robey Street. The company will erect a four-story building at a cost of $50,000.

THE ROBINSON ROGERS SUPPLY COMPANY, Denver and Salt Lake City, has taken the agency for the Hughes electric stove, made by the Hughes Electric Heating Company, of Chicago, for the Rocky Mountain territory.

THE AMERICAN CARBON AND BATTERY COMPANY, St. Louis, Mo., recently purchased the plant and good will of the Doe Battery Company, of Kent, O. Harold Rape and father, of St. Louis, are owners of the enterprise.

CHAS. L. KIEWERT COMPANY, Chicago, Ill., has moved its quarters to 58 Plymouth Court. The business of the Chicago office, under the management of W. W. Fowzer, has increased to such an extent that the change of location to larger quarters became necessary.

THE WAVERLEY COMPANY, Indianapolis, Ind., recently shipped a Waverley electric runabout to Mukden, Manchuria, for Taotai Key, managing director of the Mukden Electric Light Works. The sale was made by Fearon, Daniel & Company of Shanghai, China.

THE NOVELTY INCANDESCENT LAMP COMPANY was awarded a contract for a portion of the lamps to be supplied to the government for the fiscal year ending June 30, 1911. In making mention of the awards in a recent issue, the name of the Novelty Incandescent Lamp Company was omitted. Its contract will cover about a half-million lamps.

BRYANT & PERKINS, Bridgeport, Conn., have made a number of innovations in their 1910 Bryant-Perkins Catalog. The catalog is made larger than the previous ones, and the devices listed have been divided into groups so that anything desired may be found quickly. New devices appear in each department and many old ones have been redesigned to meet new requirements.

WALTER MACLEOD & COMPANY announce that among other contracts recently taken are one for a large plate-heating furnace for the J. Baum Safe Company, Cincinnati, O., and for complete furnace equipment for the Southern Motor Works, Nashville, Tenn. The company is also furnishing complete furnace equipment for the W. H. Clore Manufacturing Company, Washington, Ind.

THE NIAGARA LEAD & BATTERY COMPANY recently published and distributed two booklets on the Salom storage battery. One of these tells something of the development of the battery and gives quite a detailed account of the manufacture of the plates. The other, Bulletin No. 13, describes Salom batteries for automobile electric lighting. Both publications are well illustrated.

THE THORDARSON ELECTRIC MANUFACTURING COMPANY, Chicago, Ill., has issued a catalog describing apparatus for all electric dynamic experiments for elementary or advanced study in schools. The apparatus is easily dismantled and assembled as occasion requires. More than 600 experiments may be demonstrated by various arrangements of the equipment listed. The catalog is well illustrated.

THE BUCKEYE ELECTRIC COMPANY, of Cleveland, manufacturer of incandescent lamps, has located in Pittsburg a branch office to assist in the more rapid and efficient service of the lamp trade in that territory. Mr. Foster, who will be in charge of the office, is well known to the incandescent-lamp fraternity and is no stranger to Pittsburg, although for two years much of his time was spent in Indiana. He is an example of the success of clean-cut, straightforward aggressive sales methods. The offices of the Buckeye Company will be found at 112 Fulton Building.

THE WARD LEONARD ELECTRIC COMPANY, Bronxville, N. Y., recently issued a catalog entitled "Automobile Electric Lighting, Ward Leonard Automatic System, Type B," which tells the advantages of electric lighting and describes its operation. A circular entitled "Ward Leonard Automatic Electric System, Type B, Instructions for Mounting," shows in detail just how the entire apparatus should be mounted on the various makes of cars. Another circular describes just how the system operates. Diagrams are furnished so that the operation may be easily followed out.

DATES AHEAD.

Empire State Gas and Electric Association, New York, N. Y., October 5.

Denver Electric Show, Colorado Electric Club, Denver, Colo., October 8-15.

American Street and Interurban Railway Association. Annual convention, Atlantic City, N. J., October 10-14.

New York Electrical Show. Madison Square Garden, New York, October 10-20.

American Society of Municipal Improvements. Annual convention, Erie, Pa., October 11-14.

Western Association of Electrical Inspectors. Sixth annual meeting, Omaha, Neb., October 11, 12 and 13.

Railway Signal Association. Annual meeting, Richmond, Va., October 12-15.

American Electrochemical Society. Eighteenth general meeting, Chicago, Ill., October 13-15.

Order of the Rejuvenated Sons of Jove. Eighth annual meeting, Birmingham, Ala., October 13-15.

American Iron and Steel Institute. First meeting, New York City, October 14 and 15.

Illuminating Engineering Society. Annual convention, Baltimore, Md., October 24-25.

American Association of Electric Motor Manufacturers. Semi-annual meeting, Chicago, November 14-16.

RECORD OF ELECTRICAL PATENTS.

Issued (United States Patent Office) September 20, 1910.

970,473. MANUFACTURE OF LUBRICATING-OILS. Alexandre De Hemptinne, Ghent, Belgium. Filed May 11, 1909. A process for transforming oils into a viscous product, consists in subjecting a mixture of animal, vegetable and mineral oils to the action of a silent electric discharge, in any rarefied gaseous atmosphere.

970,478. CIRCUIT-CONTROLLING DEVICE. Parker Dunning, Schenectady, N. Y., assigner to General Electric Company. Filed June 10, 1910. A starting device for electric motors comprises a starting switch and a running switch both biased to open position, an operating handle movable independently thereof and arranged to close the starting switch and open the running switch when moved in one direction and to close the running switch and open the starting switch when moved in the opposite direction, and electrically controlled means for locking the running switch in closed position.

970,488. MEANS FOR HEATING METALS. Edward F. Gehrkens, Schenectady, N. Y., assignor to General Electric Company. Filed July 6, 1908. The apparatus includes a magnetic core having a gap therein, a winding on the core, and a disk-shaped piece of magnetic metal, a portion of which fits in the gap and completes the magnetic circuit of the core, and another portion or portions forming a link about the magnetic circuit of the core.

970,498. ELECTRIC METER. Jesse Harris, La Fayette, Ind., assignor to Duncan Electric Manufacturing Company, La Fayette, Ind. Filed May 3, 1909. Renewed July 5, 1910. An electric meter includes an armature, a liquid-containing chamber inclosing the armature, a storage chamber serving to hold the liquid to be used in the aforesaid chamber, a passage intervening between the chambers, and a valve in the passage for preventing or permitting flow between the chambers.

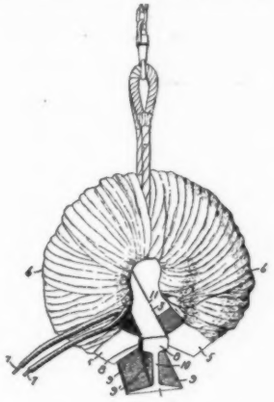
970,523. CIRCUIT-CONTROLLING DEVICE. Julius K. Lux, Washington, D. C. Filed Feb. 12, 1907. Comprises a support, cooperating contact elements carried thereby, at least one of these elements having a portion returned upon itself, and a rubbing portion extending in an opposite direction from the return portion.

970,533. CIGAR CUTTER AND LIGHTER. William A. McAneny,

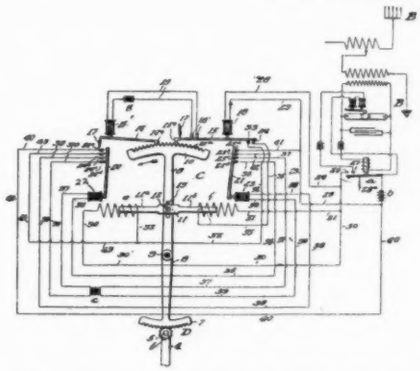
Denver, Colo., assignor of one-third to Ivy A. McLaughlin and one-third to Michael J. McAneny, St. Louis, Mo. Filed May 4, 1910. A to-and-fro movable lighter has an electrode supported in the path of movement of a part of the lighter, a circuit including this part of the lighter and the electrode, a movably mounted plate carrying the electrode, and a finger carried with the lighter and actuating the electrode-carrying plate to move the electrode relative to the path of the part of the lighter adapted to engage the electrode.

970,545. IGNITER FOR EXPLOSIVE-ENGINES. Peter Paulson, Marshfield, Wis. Filed May 10, 1909. An igniting mechanism for explosive engines comprises a pair of sparking electrodes, one of which is movable in respect to the other, a pair of pivoted arms, one of which is connected to the movable electrode and the other of which has its pivot eccentric to that of the electrode-connected lever, a common spring device reacting against the two pivoted arms and yieldingly holding the same pressed together flatwise, and a tappet operative on one of the arms.

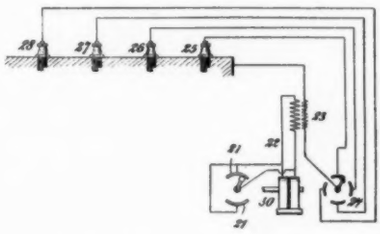
970,556. LIGHTNING-PROTECTOR. Andrew F. Rosenberger, Chicago, Ill. Filed Jan. 2, 1908. In combination with suitable supports and terminal connections, are a pair of electrodes having opposed uncovered convergent surfaces and a dielectric of greater insulating resistance than air separating the electrodes at their place of nearest approach.



970,488.—MEANS FOR HEATING METALS.



970,592.—WIRELESS CONTROL FOR SHIPS.



970,794.—IGNITION SYSTEM.

970,581. ELECTRIC-LIGHT SOCKET. Willie H. Walters, Salt Lake City, Utah. Filed Nov. 13, 1909. The device includes a threaded shell, oppositely arranged contact bars on the shell and insulated therefrom, each of the bars having a bearing, a stem of insulating material slidable in the bearings, and a contact maker on the stem for connecting either of the bars and the shell.

970,587. LAMINATED TRANSFORMER-CORE. Otto Wiemer, St. Louis, Mo., assignor to Wagner Electric Manufacturing Company, St. Louis, Mo. Filed May 17, 1909. An element for a laminated transformer core is composed of separately formed cross-pieces the end edges of which are broken lines, and yoke segments adapted to register with the ends of the cross-pieces.

970,592. WIRELESS TRANSMISSION APPARATUS FOR CONTROLLING THE MOVEMENTS OF VESSELS. Vincent C. de Ybarrondo, Los Angeles, Cal. Filed Jan. 31, 1910. In combination with vessel-steering mechanism are electromagnetic means controlling the steering mechanism and comprising two solenoids, two latches acting alternately to lock the steering mechanism in successive phases of movement, separate electromagnetic means controlling each of the latches, and electrical impulse-receiving apparatus electrically connected with one of the electromagnetic means controlling one of the latches and adapted for electrical connection with either of the solenoids.

970,600. CIRCUIT-CONTROLLING MECHANISM. Winfield A. Atwood, Schenectady, N. Y., assignor to General Electric Company. Filed Dec. 8, 1909. In combination with a switch biased to open and comprising operating mechanism for closing the switch and a latch for holding the switch closed, is a latch-actuating member movable in opposite directions through tripping position; a ratchet connection between the member and the latch is rigid during movement of the member in one direction through tripping position and yielding during the return movement of the member.

970,609. POWER-MECHANISM. Thomas R. Cook, Fort Wayne, Ind. Filed Sept. 23, 1909. An electrically operated device for compressing the gaseous fuel and supplying it to the turbine.

970,642. LIGHTNING-CONDUCTOR. Edmond Redmond, Rochester, N. Y. Filed Feb. 7, 1910. A lightning conductor consists of a metallic chain and a wire or strip passing at intervals through the links of the chain.

970,678. CLUSTER-LAMP-HOLDING DEVICE. Reuben B. Benjamin, Chicago, Ill., assignor to Benjamin Electric Manufacturing Company, Chicago, Ill. Filed Aug. 5, 1907. The device includes a supporting cap, a casing removably secured thereto, an insulating base supported in the casing and held in axial alinement by the cap, lamp-holding devices carried by the casing, contacts for the lamp-holding devices and binding-screws carried by the base.

970,684. CONTROLLER-HANDLE. Frank E. Case, Schenectady, N. Y., assignor to General Electric Company. Filed March 30, 1910. A controller having a rotatable member and has a handle carried by this member, a fixed stop, a lug carried by the handle and movable thereon into and out of co-operative relation with the stop, means on the handle for moving the movable lug, and another lug carried by the handle and fixed with reference thereto arranged to co-operate with the stop when the movable lug is out of co-operative relation with the stop.

970,693. GROUND-CONNECTOR. James L. Donald, Mooresville, N. C. Filed Dec. 19, 1908. A ground connector for conduit wiring comprises an integral metal collar interiorly pipe-threaded for engagement with a pipe end, the pipe thread by reason of its taper affording especially good electrical connection between the collar and pipe, the collar further being provided with an integral laterally extending lug having a lined aperture therein for the reception of a connecting wire.

970,698. KEYHOLE-ILLUMINATING DEVICE. Charles Eyton, Los Angeles, Cal. Filed June 2, 1910. A push button in the door knob makes an electric circuit between a battery inside the knob and a small incandescent lamp behind the knob.

970,700. ELECTRIC FURNACE FOR TRANSFORMING PIG-IRON INTO STEEL. Gustave Gin, Paris, France, assignor to Francis B. Crocker, New York, N. Y. Filed Jan. 25, 1906. An induction furnace has a hearth comprising a horizontally disposed endless crucible or channel of substantially the same cross-sectional area throughout, and an electromagent having a part thereof disposed within the space surrounded by the crucible, the crucible comprising portions therof disposed parallel with each other, and so close to each other as to largely reduce self-induction and reactance and at a distance from the magnet not less than the diameter of its horizontal cross-section taken in the plane of the crucible.

970,716. CABLE-CODE SYSTEM. Clarence H. Keehn, Indianapolis, Ind. Filed Oct. 19, 1908. A code system where in the individual letters thereof are assigned identifying number values which can be accumulated and indicated as a total by a letter or letters having a predetermined value.

970,741. PANEL-BOARD CUT-OUT AND DISTRIBUTING MECHANISM. Raymond H. Olley, Syracuse, N. Y., assignor to Crouse-Hinds Company, Syracuse, N. Y. Filed Dec. 13, 1909. A snap-switch base for a panel board is described.

970,755. ELECTROPLATING. Augustus Rosenberg, London, England. Filed March 16, 1909. The method of electroplating consists in the frictional application to an electrically conductive surface, in the presence of an electrolyte containing in solution the metal to be deposited, of a second metal electropositive with respect to both the surface and the metal in solution, the electropositive metal being in elemental and comminuted form.

970,786. DYNAMO-ELECTRIC MACHINE. Arthur J. Brown, Norwood, Ohio, assignor to Allis-Chalmers Company, and The Bullock Electric Manufacturing Company. Filed July 30, 1906. Comprises a rotary member having radial arms provided with

openings near their outer ends, bushings having beveled outer ends seated in these openings, and extending from opposite sides of the arms, collector rings having beveled portions engaging the beveled ends of the bushings, and bolts for clamping the rings and bushings to the arms.

970,794. GOVERNING MEANS FOR INTERNAL-COMBUSTION ENGINES. Charles A. Carlson, Brooklyn, N. Y., assignor to Carlson Motor & Truck Company, Philadelphia, Pa. Filed Feb. 2, 1910. A device for governing internal-combustion engines through control of the electrical ignition circuit therein comprises a closed cylindrical casing, an electrically conductive contact element therein, a radially movable centrifugal weight located in the casing and adapted under the influence of centrifugal force to engage the contact element to close circuit therethrough, a rotatable means for carrying the weight, and a spring for the weight, arranged to exert a force to move the same in opposition to the movement thereof under the influence of centrifugal force.

970,820. APPARATUS FOR REPRODUCING PICTURES OR CHARACTERS. Gustav E. Hoglund, Chicago, Ill., assignor to William N. Selig, Chicago, Ill. Filed Sept. 10, 1909. In combination with an instrument for transmitting impulses when passed over a roughened surface (the impulses varying in strength according to the varying degrees of roughness of the surface), is an instrument comprising a light for making a visual record of such impulses on a sensitized plate, the light being energized from a local circuit, a main transmission line from the transmitting instrument, and a connection between the main line and local circuit, whereby the impulses created by the transmission instrument and conveyed over the main line affect the strength of the local circuit,

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whereby the varying strength of the impulses created by the transmitting instrument produces a variation in the degree of brilliancy of the light.

970,821. AUTOMATIC EXCHANGE-SELECTOR. Howard B. Holmes, Park Ridge, and Edward B. Craft, Wilmette, Ill., assignors to Western Electric Company. Filed June 4, 1906. A contact brush is adapted to sweep over the line terminals, a ratchet loosely mounted on a continuously rotating shaft is adapted to advance this brush, and an electromagnetic mechanism secures the ratchet to the shaft to rotate therewith.

970,827. DYNAMO-ELECTRIC MACHINE. Albert S. Hubbard, Belleville, N. J., assignor to Gould Storage Battery Company. Filed July 3, 1908. Radially arranged laminations have their inner ends in close proximity to each other, so as to form a unipolar field structure.

970,865. TROLLEY. George Weber, Mount Oliver, Pa., assignor of one-tenth to Adolph Kiefer, Pittsburg, Pa. Filed June 17, 1909. A triple trolley arrangement, with guards, has the wheels arranged in tandem.

970,869. INSULATED RAIL-JOINT. Emil Carl Zimmerman, New York, N. Y. Filed March 10, 1910. A rail member provided with a head has a hole therethrough, a tube of insulating material mounted within the hole, a contact member fitted into the tube and provided with a surface substantially flush with the surface of the head, and electric connections for the contact member.

970,886. FIRE AND POLICE TELEGRAPH SYSTEM. Frederick W. Cole, Newton, Mass., assignor to Gamewell Fire Alarm Telegraph Company, New York, N. Y. Filed Sept. 27, 1907. A signal box includes a signal transmitter having a winding member, a pivoted actuating lever adapted to engage the winding member, a lever secured to the pivot shaft of the actuating lever and two independent actuators for engaging the levers to turn the pivot shaft and thereby operate the actuating lever.

970,887. FIRE-ALARM-TELEGRAPH SYSTEM. Frederick W. Cole, Newton, Mass., assignor to The Gamewell Fire-Alarm Telegraph Company, New York, N. Y. Filed April 25, 1908. The system comprises signal-transmitting mechanism, a circuit-operating device, a ground branch circuit adapted to be connected with the main circuit by the circuit-operating device, means operated by the transmitting-mechanism when one or more alarms have been sent to connect the ground branch with the main circuit and operated by the winding shaft when turned to rewind this mechanism to restore the circuit-operating device and disconnect the ground branch from the main circuit.

970,925. ATTACHMENT FOR ELEVATORS. William H. Ingle, Tacoma, Wash. Filed Sept. 14, 1909. A safety attachment for elevators comprises a supporting frame upon the floor of a car, an electromagnet supported by the frame, an armature lever (mounted pivotally upon the frame) provided with a notched flange, a housing for the electromagnet having a slot through which the notched flange of the armature lever projects, a controlling lever arranged in the path of the notched flange of the armature lever, and an electrical circuit including the electromagnet and including also a plurality of spring-actuated contact devices, one of which devices disposed at each of the elevator landings in the path of the door whereby admission to the elevator car is obstructed. The contacts are held normally open when the doors are closed, whereby the opening of one door will close the circuit and energize the electromagnet to attract the armature.

970,938. INCANDESCENT-LAMP-STEM CENTERING AND DRAWING TOOL. Robert K. Mickey, Emporium, Pa., assignor of one-half to Novelty Incandescent Lamp Company, Emporium, Pa., and one-half to E. M. Dwyer, Lynn, Mass. Filed Dec. 14, 1909. The tool comprises a shank, a pair of normally closed resilient jaws, a plunger movable in the shank to engage between the jaws for forcing them apart against their own tension, a handle connected with the shank, and a spring-pressed hand-operated lever mounted on the shank and operatively connected with the plunger to actuate the same.

970,963. ELECTRIC SWITCH. Frank W. Smith, New York, N. Y., assignor to Sundh Electric Company. Filed April 19, 1910. Includes a support, circuit contacts, a bracket projecting from the support, a guide bar on the bracket, a pivoted switch lever closing circuit at the contacts, an arm pivoted to the lever and bearing on the guide bar, a retracting spring connected to the lever and the arm, means for retaining the switch lever in circuit-closing position, and means for releasing the retaining means.

970,975. PRIVATE-BRANCH INTERCOMMUNICATING TELEPHONE SYSTEM. John N. Wallace, La Crosse, Wis., and Edward B. Craft, Chicago, Ill., assignors to Western Electric Company of Chicago, Ill. Filed Nov. 23, 1907. A trunk line is multiplied with two or more stations of the system with switch-means at each of these stations for connecting the telephone set thereof to the trunk line, a path in substitute of the telephone for maintaining the direct-current continuity of the trunk line, and a relay associated with the trunk line for controlling the insertion of the substitute path, the relay being unresponsive to the normal current of the trunk line, but being responsive when the central office operator has plunged into the trunk line.

971,002. COVER FOR ELECTRICAL OUTLET-BOXES. Edgar H. Freeman, Trenton, N. J., assignor to E. H. Freeman Electric Company, Trenton, N. J. Filed June 24, 1910. An outlet-box comprises a cover plate, insulating bushings fitted to the cover plate and a metallic cap plate secured upon the cover plate and having a holding engagement with the bushings.

971,006. ELECTRIC RAILROAD. George P. Horton, Washington, D. C. Filed Sept. 30, 1909. A conduit system is described.

971,010. ELECTRIC GAS-LIGHTING DEVICE. Robert A. Jewett, Worcester, Mass. Filed July 3, 1907. The act of turning on the gas valve causes co-action of wiper fingers to produce a spark to ignite the gas.

PATENTS THAT HAVE EXPIRED.

Following is a list of the electrical patents (issued by the United States Patent Office) that expired September 26, 1910:

505,467. SECONDARY BATTERY. Isidor Kitsee, Philadelphia, Pa.

505,539. FIELD MAGNET CORE FOR DYNAMOS OR MOTORS. George S. Strong, New York, N. Y.

505,561. ELECTRICAL CONNECTION. William I. Smith, Memphis, Tenn.

505,585. ADJUSTABLE SUPPORTER FOR ELECTRIC OR OTHER LAMPS. Otis C. White, Worcester, Mass.

505,605. CLOSED CONDUIT FOR ELECTRIC RAILWAYS. George W. McNear, Oakland, Cal.

505,622. DYNAMO-ELECTRIC MACHINE. Arthur S. Atwater, Cleveland, O.

505,628. DUPLEX TELEPHONY. William Marshall, New York, N. Y.

505,665. DYNAMO-ELECTRIC MACHINE OR ELECTRIC MOTOR. Robert Lundell, Brooklyn, N. Y.

505,686. CONTROLLER ROLLER FOR ELECTRIC CARS. Ernest P. Warner, Chicago, Ill.

505,687. AUTOMATIC PASSENGER TRAIN ANNUNCIATOR AND ALARM. Alfred E. Watts, Duluth, Minn.

505,724. COIN-CONTROLLED ELECTRIC-CALL APPARATUS. Graydon Poore, London, England.

505,729. ARMATURE FOR ELECTRIC MOTORS. William J. Sherwood, Ashtabula, O.

505,730. TELEPHONE CIRCUIT. Theodore Spencer, Cambridge, Mass.

505,783. ELECTRIC MOTOR. Ralph Ashley, Philadelphia, Pa.

505,798. MANUFACTURE OF CABLES FOR MULTIPLE SWITCHBOARDS. Oro A. Bell, Brooklyn, N. Y.